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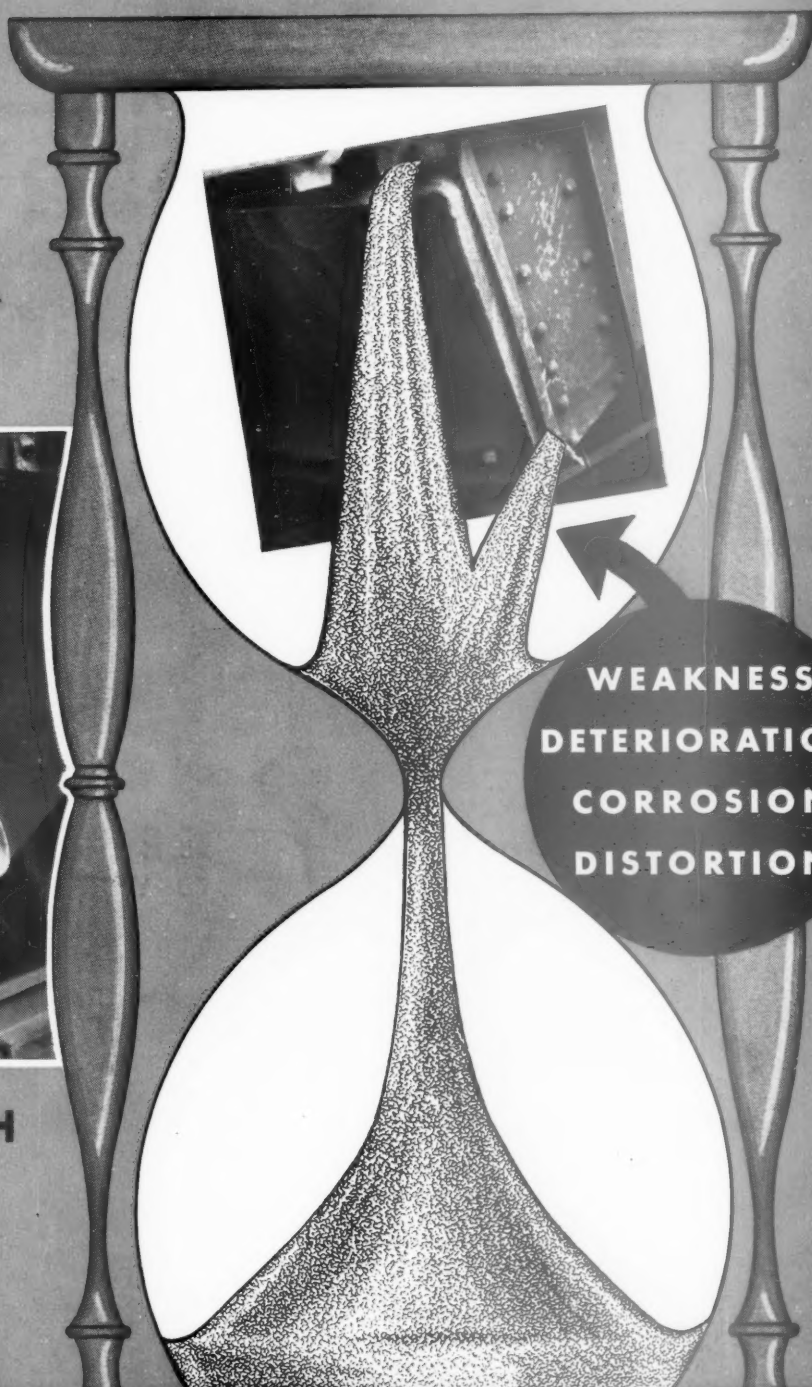
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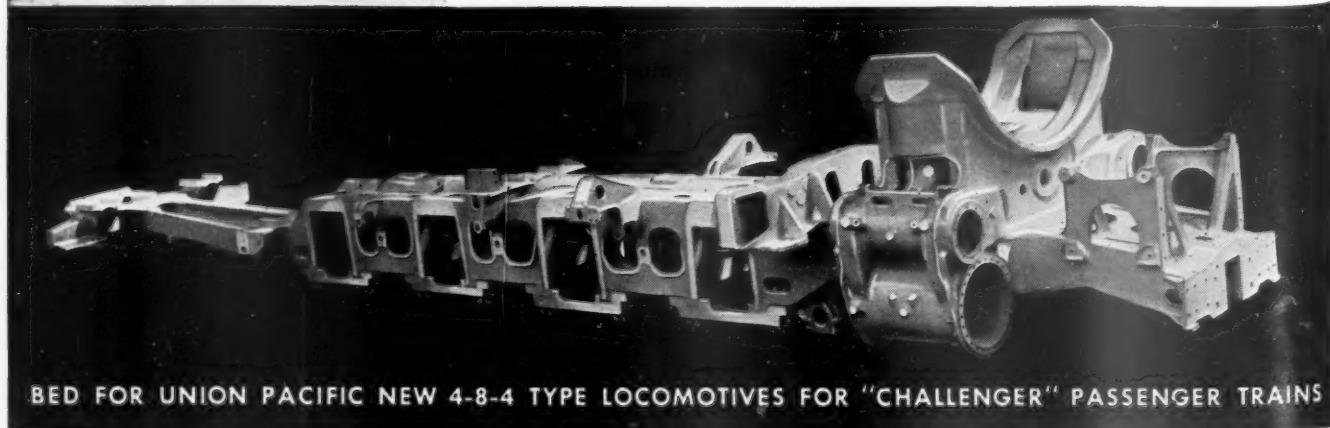


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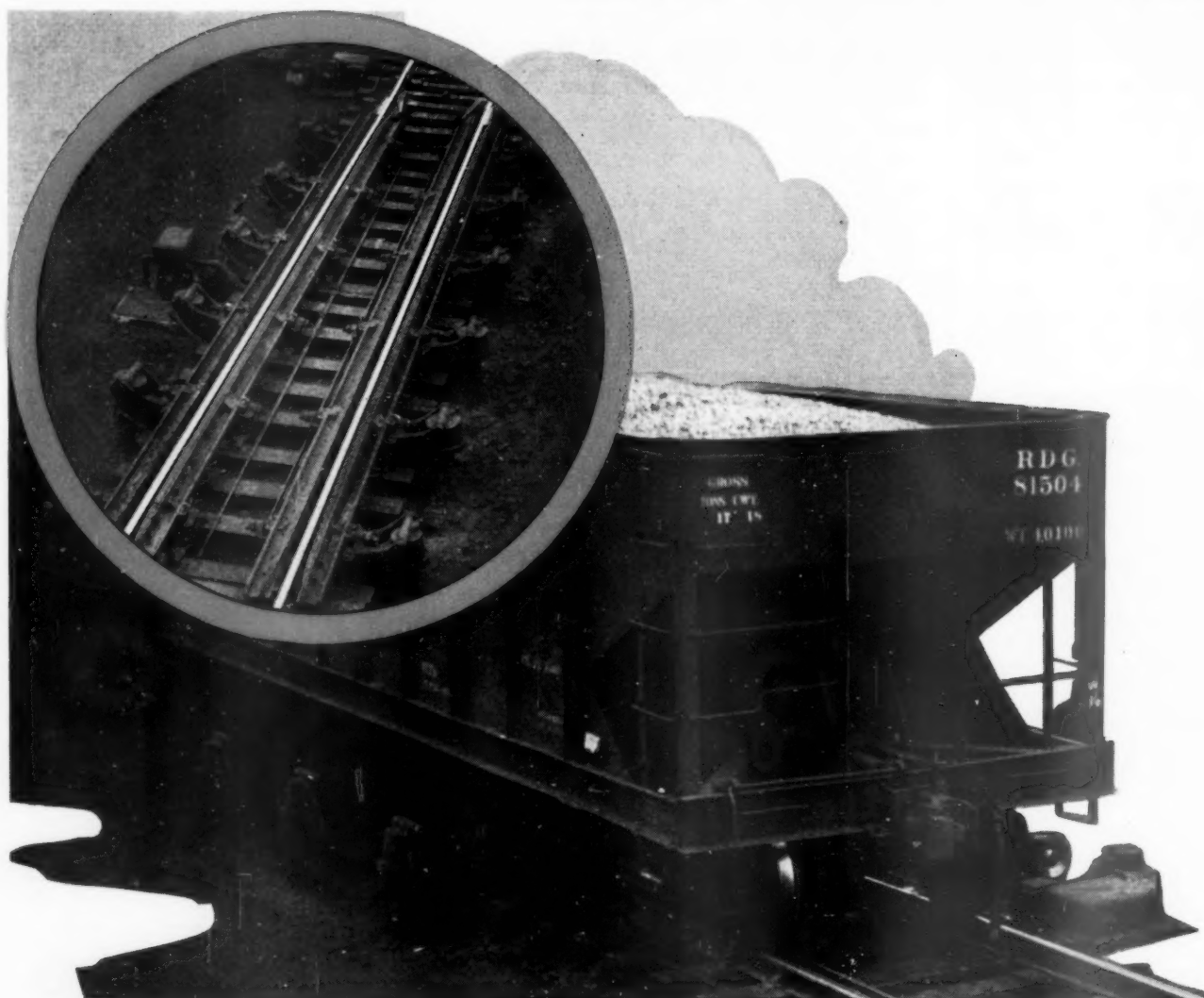
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The *Railway Age* is indexed by the *Industrial Arts Index* and also by the
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NOT MERELY A FAIR WEATHER PROPOSITION

During 1933, the A. A. R. Signal Section surveyed the railroads having car retarders, for the purpose of collecting data with reference to installation cost, cars handled, and the savings effected. This survey was made during a period of abnormally low traffic conditions.

The average annual return on the capital invested in 16 installations was 42.86 per cent!

An average saving of 28 cents per car handled was effected by the retarders.

Large additional savings were reported by four roads as a result of eliminating switching at other points. » » » » » » » »

If car retarders effected such large savings during abnormally low traffic conditions, calculate their possibilities under present normal conditions. » » » » » » » »

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1937

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The Week at a Glance

CARLOADINGS: For the July 3 week revenue carloadings totaled 806 thousand—a new high for the year, being 24 per cent above a year ago (but the comparable week last year contained the July 4 holiday).

CAR SHORTAGE: Minor car shortages here and there, and the fear that more serious ones may develop later, occupied the attention of the meeting of the Midwest Shippers' Board in Chicago last week. A news account of the meeting gives details of some of the problems the roads and shippers, working together, are trying to solve.

SLAMS R.R. TRUCKING: The K. C. S. wants to inaugurate truck routes to parallel its entire railroad, proposing to hook up the trucks with its train schedules and provide a thoroughly co-ordinated service. But not if Examiner Peyser of the I.C.C. motor carrier bureau can stop it. He believes that co-ordination means a hook-up between rail and motor, with both under separate ownership, and he has recommended that the Commission veto the K. C. S. plans for improved and co-ordinated service, except on a couple of short routes.

BRAVE SWITCHMAN: President Roosevelt has awarded a medal of honor to C. St. P. M. & O. Switchman Arnold F. Haack of Superior, Wis., for saving the life of a woman who fell under a train, at great personal risk to his own safety.

Q HIGHWAY LINES: The Burlington has asked the I.C.C. for authority greatly to extend its interest in truck and bus lines in its territory. It seeks to buy a half interest in Black Hill Stages and all of a truck line operating between Kansas City and the Twin Cities, and Kansas City and Chicago. Also it asks approval of a lease of the operating rights of a bus line between Chicago and Aurora, Ill.

TRAIN RESISTANCE: A summary of the factors which affect the resistance of modern light-weight streamline trains is given in an article herein in a form designed for easy practical application to specific problems involving the determination of such resistance.

ALTON STREAMLINER: The Alton on July 26 will place in operation another light-weight streamlined train in daily round-trip operation between Chicago and St. Louis. The equipment to be used is that formerly in service on the B. & O.'s "Royal Blue" between New York and Washington.

RETARDING RECOVERY: Governmental policies designed to change the distribution of incomes are working in a manner greatly to curtail the amount of income available for distribution. This is the inevitable conclusion from car loading figures, set forth in the leading editorial herein, which show that recovery from

the recent depression is the slowest ever recorded; and that total production is still 25 per cent below the 1929 level after four years of "recovery." The lag has resulted, the editorial points out, principally because of the artificial curtailment in agricultural production and because of governmental policies which make people afraid to invest their money in normal amounts in building. Restoration of pre-depression building volume alone, it is asserted, would be sufficient to absorb practically all existing unemployment. But people won't invest when government and labor union policies are such as to limit the chances that investments will pay out.

O. & W. TRUSTEE: The I.C.C. through Division 4 this week refused to ratify the appointment of Vincent Dailey, prominent in Democratic political circles in New York, as co-trustee in bankruptcy of the New York, Ontario & Western. At the same time it approved the naming of Frederick E. Lyford as trustee, thereby giving him the responsibility alone. Objection was made to Mr. Dailey's selection because of his lack of railroad experience and because he did not plan to devote all his time to the railroad, whereas Mr. Lyford has had wide experience in railway work and plans to give all his time to the O. & W. The commission did not feel that a road as small as the O. & W. required two trustees.

EMPLOYMENT GAINS: Railroad employees on June 1 totaled 1,171,302, a gain of $8\frac{3}{4}$ per cent over June a year ago. More than a quarter of a million furloughed and new employees have gone to work on the railroads since the low point of the depression (March, 1933), when only 919,881 were working. And the number back at work would doubtless be much greater if it were not for political interference and threats and strikes which scare investors and keep them from making investments which would increase production and hence railway traffic and employment.

CONSTRUCTION COSTS: The index number of railway construction costs in 1936 was 143 (1910 to 1914 = 100), according to the compilation of the Bureau of Valuation of the I.C.C., details of which are given in an article herein. The low point was reached in 1932-33, when the index stood at 133. Construction items in which manual labor has largely been supplanted by mechanical methods have shown receding costs in recent years.

CONCRETE PERMANENT?: The Civil Engineering Research Laboratories of Columbia University have recently made a thorough study of the factors which cause deterioration in concrete structures. The results of this study are summarized herein in an article which will serve as a practical guide toward the prevention of many failures. Proper attention to mixtures, and waterproofing, are the principal methods of promoting permanence.

E. E. LOOMIS: The chairman, and until recently president, of the Lehigh Valley died last Sunday. Mr. Loomis, in addition to the distinction he won as executive of this road, was also widely and favorably known, in his capacity as chairman of the Eastern Railroads' Committee on Public Relations, as a spokesman for the railway cause in general. An article herein gives an outline of his long and useful career.

U. P. EQUIPMENTS: The Interstate Commerce Commission this week authorized the Union Pacific to assume liability for and sell \$10,410,000 of 15-year equipment trust certificates, the biggest deal of this kind to come up in some time. The money will cost the railroad a little over $2\frac{1}{2}$ per cent.

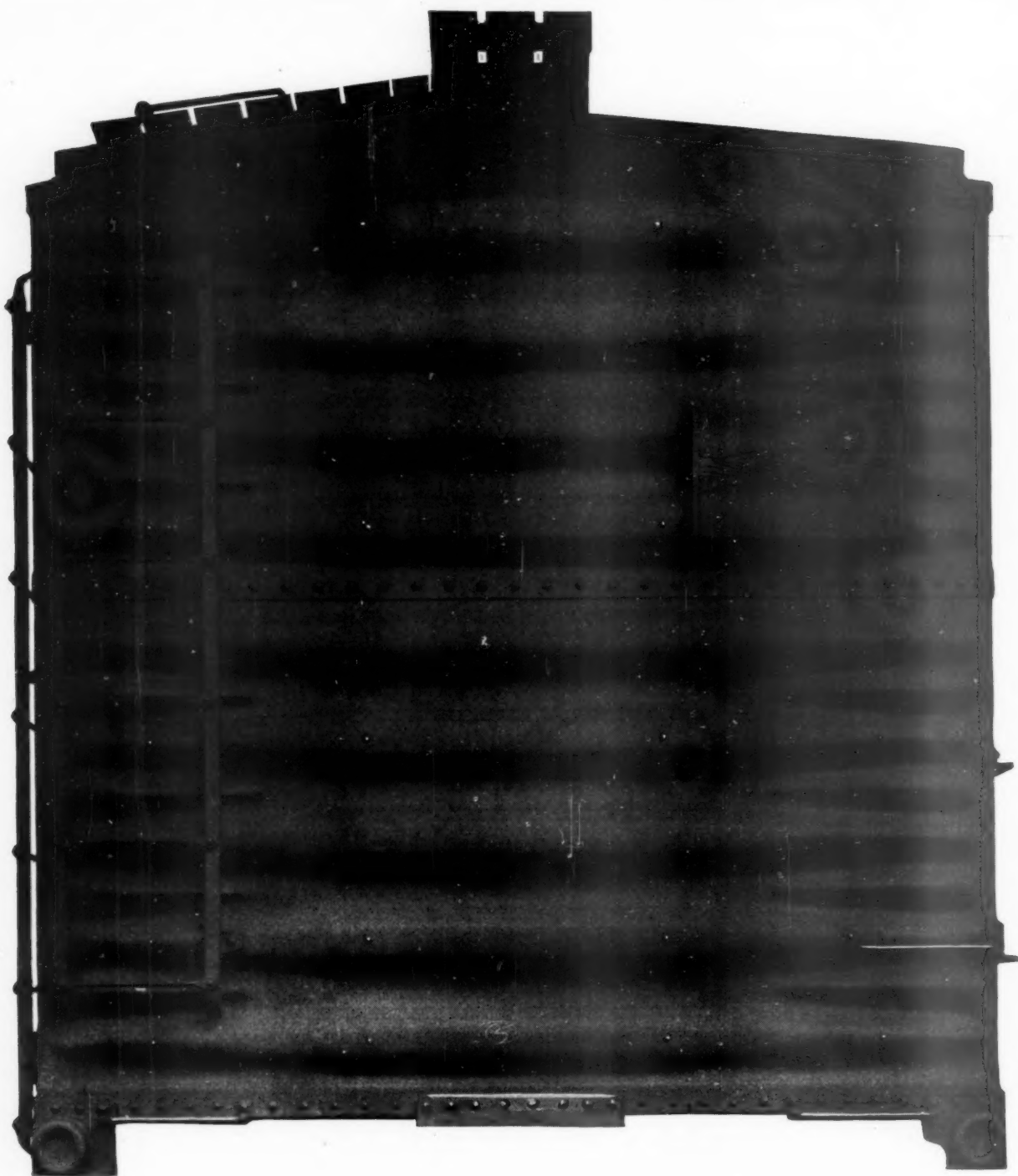
NO SEAT, NO PAY: The appellate division of the New York Supreme Court has recently sustained an award of \$47 damages to a passenger who had to stand on a coach journey of some 150 miles. The passenger refused to surrender his ticket when the conductor asked for it.

EASTMAN RENAMED: President Roosevelt has re-appointed Commissioner Joseph B. Eastman to the I.C.C. for another term. Mr. Eastman's term expired at the end of last year and since that time he has continued to serve under a provision which continues a Commissioner in office until his successor is appointed. Commissioner Tate, whose term likewise has expired, continues on this interim basis.

BRITISH ELECTRIFY: The Southern (England) on July 4 opened to electric operation its line between London and Portsmouth which, with a branch included in the project, adds 95 electrified route miles to its electrified lines and brings the electrified route mileage of the Southern to a total of 540.

FREE I.C.C.: The Association of Practitioners before the I.C.C. has gone on record as opposed to any change in the status of that body which would curtail its freedom to determine its policies within the legislation defining its jurisdiction; or which would interfere with its personnel. The views of the practitioners on this question have been transmitted to members of the committees in Congress which are considering legislation providing for governmental reorganization.

WAGE PARLEY: Leaders of the 14 non-operating unions this week resumed conferences at Washington with representatives of management on their demand for a 20-cents-per-hour wage hike and other improvements in their status. The conference was resumed at the instance of the National Mediation Board, which was expected to enter the negotiations on Friday if the conferees had made no progress up to that time. It is rumored that the management group has offered a raise of 2 cents an hour, and has put out "feelers" on 4 cents.



WHEN THE DRAFT GEAR STOPS

THE DREADNAUGHT END STARTS

YIELDING UNDER EXTREME IMPACTS ONE FOOT
AS A CUSHION AGAINST THE SLIDING LOAD

RAILWAY AGE

How Much Recovery Has There Been?

Four years ago this month the recovery policies of the New Deal began to go into effect. What is "recovery"? Following every previous depression in this country it was an increase in the production and distribution of commodities to levels far higher than any ever reached before. The amount of freight shipped by railroad is the best single measure of total production and distribution. The bottom of the depression of the nineties was reached in 1894. Four years later the freight business of the railroads was 22 per cent larger than their pre-depression maximum business. How large is it now after four years of "recovery" since

of operating expenses to gross earnings is almost as low as in 1929—74.52 this year as compared with 73.65 per cent in 1929. Nevertheless, their net operating income in the first five months of 1937 was still 48 per cent smaller than in 1929. The railroads certainly are not enjoying anything that would have been called "recovery" after any previous depression.

Railroad Lag Due to Lags in Other Industries

It is often said in reply to citation of such facts that the railroads present a special case—that their failure to recover is due to competition to which they were not

Table I.—Railway Results

First Five Months of 1929, 1933 and 1937

	1929	1933	1937	Per cent Decrease 1933 under 1929	Per cent Increase 1937 over 1933	Per cent Decrease 1937 under 1929
Total Car Loadings	21,325,072	10,931,027	15,951,584	-48.7	+ 45.9	-25.2
Total Operating Revenue	\$2,534,928,165	\$1,136,911,877	\$1,735,611,207	-55.5	+ 52.7	-31.5
Total Operating Expenses	\$1,866,995,431	\$883,616,031	\$1,293,397,787	-52.7	+ 31.7	-30.7
Taxes	\$162,544,884	\$109,042,307	\$150,341,481	-32.9	+ 37.9	- 7.5
Net Railway Operating Income ...	\$457,017,244	\$94,918,398	237,645,050	-79.2	+150.4	-48.0
Operating Ratio	73.65%	77.72%	74.52%
Rate of Return	5.60%	1.06%	2.73%

1933? In the first five months of 1937 car loadings of freight were almost 49 per cent larger than in the first five months of 1933, but *were still 25 per cent smaller than in the first five months of 1929.*

Railroads Far from Recovery

The statistics given in Table I show how much "recovery" there has been in the railroad industry. The number of cars loaded with freight in the first five months of 1933 was 10,394,045 less than in the first five months of 1929. The number loaded in the first five months of 1937 was still 5,373,488 less than in the first five months of 1929. Therefore, after four years of "recovery" the railroads had recovered less than one-half of the freight business that they lost during the preceding four years. Due to declines of both traffic and rates their gross earnings were 31.5 per cent less than in 1929. That they are being operated with great efficiency and economy is demonstrated by the fact that, in spite of this decline of gross earnings, and of wage scales slightly higher than in 1929, their ratio

formerly subject. In some measure this is true, and it would appear that to the extent that their situation is due to government discrimination in aid of their competitors it calls for changes in government policies. But, in fact, the failure of the railways to recover is mainly due to lack of recovery in some of the most important industries from which they derive their traffic.

There are given in Table II statistics of car loadings by classes of commodities in the first five months of 1929, 1933 and 1937. That loadings of grain and grain products were 31 per cent less and of live stock 53 per cent less in 1937 than in 1929 was mainly due to the government's policy of restricting farm production to raise farm prices. The effort to raise farm prices as compared with industrial prices has been commendable. But the effort to raise farm prices has been constantly accompanied by government efforts to advance hourly wages and reduce hours of work in industry, resulting in advances of industrial prices that have intensified the need for restricting farm production in order to maintain a parity of farm and industrial prices. The success of government efforts to produce a scarcity of

farm products has caused a scarcity of traffic in farm products for the railways.

Building Construction 60 Per Cent Less than Before Depression

Compared with 1929, relatively one of the largest declines of car loadings still shown is the 44.5 per cent decline of loadings of forest products. And this forcibly calls attention to one of the principal causes of the continued lagging of business in general and of

The lagging of building alone is sufficient largely to account for this.

Government Policies and the Lag in Building

Why has building not recovered? The country is not over-built. There is a general shortage of residential buildings. There would be shortages of other kinds of buildings if there had been real recovery in business in general. Most buildings, including residential buildings, are erected as an investment. They constitute

Table II.—Freight Car Loadings

First Five Months of 1929, 1933 and 1937

	1929	1933	1937	Per cent Decrease 1933 under 1929	Per cent Inc. or Dec. 1937 compared with 1933	Per cent Inc. or Dec. 1937 compared with 1929
Grain & Grain Products	917,745	673,568	636,344	-26.6	- 5.5	-30.7
Live Stock	579,965	346,582	276,554	-40.2	- 20.2	-52.9
Coal	3,793,995	2,113,458	3,123,714	-44.3	+ 47.8	-17.7
Coke	276,825	101,244	247,956	-63.4	+144.9	-10.4
Forest Products	1,414,481	364,518	785,433	-74.2	+115.5	-44.5
Ore	597,675	79,442	618,656	-86.7	+678.8	+ 3.5
Merchandise—l.c.l.	5,540,160	3,472,138	3,632,164	-37.3	+ 4.6	-34.4
Miscellaneous	8,204,226	3,780,077	6,630,763	-53.9	+ 75.4	-19.2
TOTAL	21,325,072	10,931,027	15,951,584	-48.7	+ 45.9	-25.2

railroad traffic in particular. The Federal Reserve Board recently reported that "industrial production" in May was virtually as large as in May, 1929. But it does not include construction in "industrial production." In the three years 1927-1929, inclusive, expenditures in this country for the construction of non-residential buildings averaged \$2,519,000,000 and of residential buildings \$2,426,000,000 annually, a total of \$4,945,000,000 annually. Total expenditures on buildings had declined in 1933 to \$653,000,000. They increased in 1936 to a total of \$1,755,000,000. For the first five months of 1937 the figures are \$440,000,000 for non-residential building and \$424,000,000 for residential building—a total of \$864,000,000. What these statistics show is only too plain. Building construction in this country was carried on during the three years preceding the depression at an annual rate of \$4,945,000,000. It is now being carried on at an annual rate of only about \$2,000,000,000—a relatively very large increase since 1933, but a rate still 60 per cent less than in the three years before the depression. Lumber is still the principal material of building construction; and to the failure of building to recover is due railroad loadings of forest products still 45 per cent smaller than in 1929.

Building is such a large industry that the fact that it is still 60 per cent less than in the pre-depression years probably is the most important and significant fact regarding the present general business situation. In large measure it accounts for the lagging of recovery shown by railroad freight loadings. It is largely responsible for the continuance of unemployment and the assumed or real necessity for continued large relief expenditures. The American Federation of Labor estimated last week there are still 8,000,000 unemployed.

good investments, however, only if they can be erected at costs and under actual and prospective business conditions giving assurance that they can be profitably rented or used. The only possible explanation of the lagging of building is that the relationship between the construction costs of new buildings and the prospective income from their ownership has not yet become such as to afford sufficient incentive to cause a full revival of building. The government for four years has been following policies calculated unduly to increase the labor costs both of building materials and of construction work. At the same time it has been following policies tending to curtail and make uncertain returns on all investments. These efforts of the government to "help labor" and especially the so-called "underprivileged" are largely responsible for increases in construction costs and lack of confidence in investments that have prevented revival of both residential and non-residential building.

There is another important item of general business that may well be mentioned in this connection. Railway buying from the manufacturing industry has increased greatly within the last two years. But in the first five months of 1929 it was \$634,000,000 and in the first five months of 1937 only \$419,000,000, or 34 per cent less. It is determined much less by the needs of the railways than by the amount of net operating income they earn, and will be restored to a real recovery basis only as and when there is real recovery in the railroad industry.

Why is Recovery the Slowest in History?

The "industrial production" statistics of the Federal Reserve Board are entirely misleading as a measure of

the country's total volume of production and commerce and, therefore, of the extent of its recovery from the depression. Railroad freight loading figures are a much better measure—in fact, the only valid single measure—because, unlike statistics of “industrial production,” they reflect farm production and building construction. Freight loadings statistics for the first five months of this year indicate that during the last four years of “recovery” business as a whole has regained only about one-half of the ground that it lost during the preceding four years. This is the slowest progress out of a depression ever recorded in the country's history. The slow progress made has been principally due to economically unsound policies intended to change the *distribution* of wealth and income, the proponents of which have disregarded the seemingly obvious facts that the volume of *production and construction* determines the amount of wealth and income available for distribution, and that there can be no real recovery from depression that is not based on complete recovery of production and construction. Only policies of redistribution that do not hinder or that actually stimulate production and construction can benefit any class, especially “labor” and the “underprivileged.” The laws of economics are natural laws that are as unchangeable as other natural laws. There is no economic demand for labor excepting for the production of goods, services, buildings and other things at costs and prices that those who want these things can and willingly will pay.

The market for labor is afforded by the entire consuming and *investing* public. The economic theory prevailing in government for four years has been that recovery could and would be caused by increasing the “purchasing power of labor.” This was to be accomplished by (1) reducing hours of work and thereby increasing the number of workers receiving wages and (2) advancing wages and thereby increasing the buying power of each wage-earner. The principal fallacy of this theory is its disregard of the vitally important fact that a large part of the buying necessary to afford full employment and cause maximum production and

construction is done through the *investment of capital*; and that policies as respects wages, working hours, taxation and the currency which unduly increase costs of production and construction and prevent confidence in future profits inevitably hinder the investment of capital.

Fluctuations in Freight Loadings

Railroad freight loadings in the first five months of 1937 were 15.6 per cent larger than in 1936. In June they were only about 9 per cent larger, and indicated that the pace of recovery, which during the preceding four years had been slower than after any preceding depression, was declining. In the week ending July 3, however, there was a sharp upturn that carried loadings to 24 per cent above those for the corresponding week of 1936. Owing to floods the increase in loadings declined in February to less than 10 per cent, but the movement of a large amount of traffic was only delayed, and in consequence in March the increase advanced to 24 per cent. The sharp advance in the week ended July 3 apparently was due not only to a large increase in grain movement but to the movement of other traffic that was delayed in June by labor troubles. It still looks as if the increase in loadings throughout the year will average 15 per cent and that the railways will be hard pressed to handle the peak fall traffic with the equipment they will have available.

But while business in general is still improving, it should be emphasized that recovery during the last four years has been very slow and unsatisfactory as measured by experience following previous depressions, that this has been due to so-called “recovery” policies that actually have prevented and are still hindering full recovery, and that if the country ever is to attain the prosperity that it should there will have to be adopted policies that will afford more opportunity and encouragement to the increased investment of capital essential to needed enlargements of production and construction.

On a Thinning Diet

Wage negotiations between railroad workers and management are proceeding according to traditional custom—it might almost be called a ritual. No one supposes that strike votes mean a strike; things do not happen that way in the railroad industry. Nor does anyone suppose that the workers' demands are predicated upon railroad ability to pay. The opening demands of the various worker groups would, if applied to the industry as a whole, on the basis of last year's business and earnings, leave the carriers as a whole deep “in the red” on their fixed charges. No one supposes that these demands were made with the expectation that they would be the workers' last word under penalty of strike. But everyone acquainted with the situation is well aware that at the end of the talk railroad managers will find that they have to pay more for labor.

—From the Wall Street Journal.

How much more is, of course, uncertain. Colonel Ayres guesses that the increase will be 10 per cent on last year's wage bill. This would mean about \$190,000,000, which is more than last year's aggregate surplus over fixed charges. It is admitted that the real wages—as distinguished from money wages—of rail workers employed today are higher than at any time in their history. As things stand in this controversy, however, the relevance of that fact is not admitted by the worker representatives as a determinant.

The sum and substance of the matter is that the rising tide of railroad costs relative to earnings is headed for another high mark. It has been said, and the metaphor is apt, that the railroad industry is afflicted with progressive anemia. The disease is, apparently, about to make another advance.

How Permanent Is Concrete?

Ten year study focuses attention on the solubility in water of some of the main compounds formed by the original hydration of the cement

By David L. Snader

Former Research Fellow, Columbia University
Professor of Civil Engineering, Stevens Institute of Technology

THE portland cement industry in the United States stands as one of the great industries of the world, and it developed with unprecedented rapidity during the early years of the twentieth century. Paralleling this extraordinary growth was the use of concrete for engineering structures, not only for those works which had hitherto been built of cut stone masonry or brick, but also the great growth of reinforced concrete as a

substitute for earlier timber and for many steel constructions.

It was more or less generally stated as a basis for this latter movement that portland cement was a permanent material and that structures built of it, unlike steel work, would require little or no maintenance. Naturally, in such a rapid growth, some mistakes were made and concrete was used under conditions and for works to which it was not entirely suited. Furthermore, little scientific knowledge was available as to the requirements in mixing, placing and curing concrete. Such failures as occurred, therefore, were generally attributed to mistakes made in the manufacture of the concrete or to the use of improper aggregates.

In recent years it has become increasingly clear that the older slogan of "concrete for permanence" is only relatively true. In brief, concrete is an artificial stone, and as earlier experience with natural stone would have indicated, the forces of nature, particularly the action of water, cause deterioration even in the most compact and hardest rocks, be they natural or artificial. Clearly, concrete can be no exception to this general rule, even with our present knowledge of the requirements in proportioning, mixing and placing; nor can concrete in exposed positions be expected to resist indefinitely those great forces of nature which have produced the soils now covering the earth through the erosion of igneous, sedimentary and metamorphic rocks. In the course of time, therefore, exposed concrete must obviously be expected to deteriorate.

Some 10 or 15 years ago the engineering profession began to question the permanence of certain types of concrete structures under the general conditions of use then existing, particularly of structures exposed to weathering or to the action of water. Attention was repeatedly focused on the problem by the appearance of cost items for repairs and replacements, and through the resulting inconveniences and interruptions in the normal use of the structure. Difficulties had been experienced, for example, with concrete dams subject to considerable water pressure, and in a number of other types of structures it also appeared that the concrete was cracking and disintegrating. Such disintegration was not confined to a certain few structures but was rather widely distributed, occurring under varied atmospheric and climatic conditions. Further, deterioration sometimes began at a relatively early age, and in some cases proceeded to such degree that the safety and integrity of the structure were questionable. At this time, the Civil Engineering Testing Laboratories at Columbia University undertook an extensive research to discover if possible the causes of this disintegration, and the possible remedies which might be applied.



Fig. 1



Fig. 2

A Piece of Aggregate and of Broken Concrete Which Are Typical of a Condition Frequently Found When Water Penetrates Concrete. The Cement Matrix Was Soft and Crumbly. The Aggregate Was Sound and Loosened in the Concrete. The Stone Surfaces Were Largely Covered, and the Cement Matrix Well Saturated with the Deposits Resulting from Later Hydrolysis

It was not the purpose of this investigation to study the effect of special deteriorating agencies on concrete, such as oils, acids or alkalis, but to confine the studies to conditions accompanying what has been termed normal use. The economic use of concrete under differing conditions, as well as its improvement in quality so as to render it a more reliable and even more widely applicable material, requires a careful consideration of both its structural characteristics and properties, as well as its resistance to deterioration. All materials have certain inherent qualities and characteristics and, unless these can be modified or changed through improved methods of preparation or manufacture, these qualities become limitations to proper use if desired results are to be obtained.

In studying the problem of the deterioration of concrete there are obviously two main elements to be considered—the resistance of the material to the forces causing deterioration and the nature and extent of these forces. In this investigation, begun some 10 years ago, the attempt has been made to study both of these phases of the problem.

The Deterioration of Concrete

Modern specifications usually require a quality of coarse aggregate in concrete which is almost invariably a stronger and more resistant element than the binding

This is an abstract of a report issued by the Civil Engineering Research Laboratories, Columbia University, published in Bulletin No. 5, February, 1937. Included in this bulletin, with the report, is an appendix containing the results of chemical investigation, studies of concrete specimens and other data submitted in support of the conclusions appearing in the report itself and which are reproduced in full herewith.

matrix of cement and sand. The critical factors as regards the deterioration of concrete are thus almost invariably either the quality of the cementing material or the mixing, placing and curing of the mixture.

Great attention has been given in the past to the matter of mixing, placing and curing of the concrete. The importance of these operations in securing a strong and more nearly impermeable product has been clearly demonstrated. These important factors in manufacture help to protect the concrete from, or give it qualities which retard, the action of deteriorating agencies. The earlier studies undertaken in this investigation, however, showed that the final deteriorating action takes place in the cementing material itself—in that complex, hydrated chemical product which we call portland cement. Proper mixing, placing and curing may thus retard or postpone deterioration, but ultimately, if deterioration becomes active, it will be found that generally it is the cement itself which has broken down.

With this point in mind Bulletin 4, previously published, covered a detailed study of the characteristics and properties of the principal chemical combinations which were believed to make up standard portland cement. As a parallel line of investigation, however, nearly 200 samples of concrete were secured from widely scattered structures under varied conditions of service. And an exhaustive study of these representative samples



Deteriorated Concrete from a Railroad Bridge Abutment. The Softened Cement Matrix Had a Whitish Color

appears to confirm the tentative conclusions which were suggested by the previous tests, namely, the final element in the deterioration of concrete is instability of the hydrated cementing material under the action of water.

Forces Causing Deterioration

In connection with the above mentioned samples it should be noted that these samples are representative of different kinds of structures, built in different localities, and serving under various exposure conditions and requirements. Historical data, as complete as possible, were also secured for these samples, as well as data on the character of the materials used, on proportions, methods and conditions of manufacture, service requirements and other conditions. In addition, field inspections have been made at the site, of many concrete structures which have shown deterioration in varying degree.

These samples furnished invaluable data by means



Part of a Railroad Bridge Abutment in an Advanced State of Deterioration

of which the characteristics of deterioration as it actually occurs in concrete structures could be studied and compared with the results of the earlier investigations. Together with the records of their history, location and exposure, they also formed an interesting basis for studying the forces which were active in causing this disintegration.

The present paper may thus be considered as a final summary and report of conclusions covering a detailed investigation which has extended over a period of 10 years. It is hoped that the results of this study and the conclusions drawn from it may be of interest to the civil engineering profession and portland cement industry.

Conclusions

It is, unfortunately, impossible to publish the details of all of the studies and tests which have been made in connection with this investigation, for 370 compression tests were made; over 800 photographic and photomicrographic records and studies were carried out; 22 field trips were taken for inspection and study of con-

building construction and similar works—may be regarded as a relatively permanent structural material and one that will give satisfactory service for a period of many years; with an indefinite life probably extending into a century or more. In brief, in a good quality of concrete the aggregate is made up of stable materials, and the cementing medium itself in a protected structure is not subjected to deteriorating influences.

2. It is believed that this investigation has shown conclusively, that the final and the most important element leading to deterioration of concrete in normal service is later contact water, water which is present under many service conditions and finds entrance into the concrete mass. It is impossible to state how rapidly disintegration may take place in terms of these later water conditions. It seems obvious, however, that even atmospheric moisture—that is, the alternate wetting and drying due to rain and snow—will produce, even in the best unprotected concrete, a gradual weathering and breaking up of the mass.

More fully, the fundamental difficulty appears to be due to the fact that some of the main compounds formed

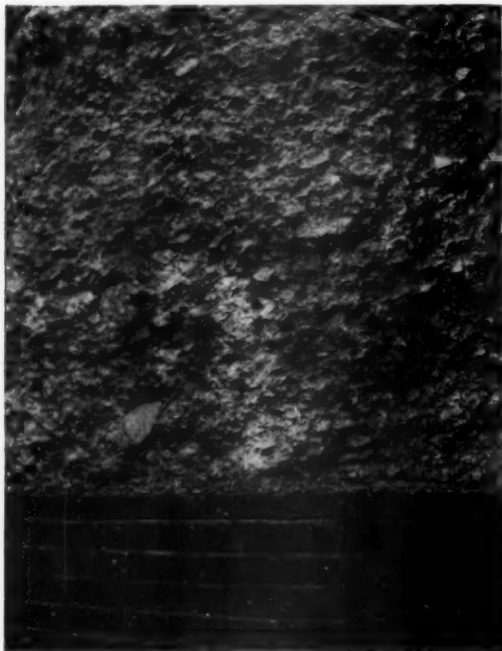


Fig. 1

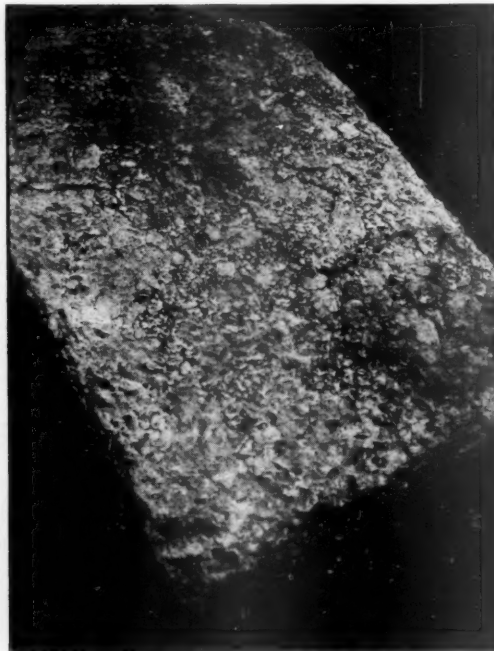


Fig. 2

Advanced Stage of Surface Deterioration in Two Different Railroad Bridge Abutments Subjected to Intermittent Water Penetration. Fig. 1 Shows the Condition That Existed in Eight Similar Structures in the Same Locality

crete structures in service; over 100 conferences were obtained with engineers and owners of structures; and over 10,500 determinations, measurements and other studies were made in connection with the concrete samples and the cementing compounds. A complete record, however, of all of these studies and tests is on file at the university, and is open for inspection by those interested. Even though brief, it is believed that the appendix to this bulletin summarizes the scope, character and results of this investigation in sufficient detail to justify the following conclusions.

These conclusions apply to the general class of unprotected concrete structures under normal conditions of service. The unusual and special cases which are due to special causes are not considered; and the corrosion of steel and defects in design and construction are also not included.

1. Concrete when used in protected locations—that is, where it is not subjected to atmospheric weathering or to abnormal physical conditions, as, for example, in

by the original hydration of the cement are soluble in water. The action of later, uncombined water, which frequently finds entrance during the service of the structure, thus tends toward a partial breaking down of the vital binding medium, by leaching out these soluble compounds. This is particularly true when water percolates through the structure, thus bringing a fresh solvent continually in contact with the soluble products of hydration of the cement.

3. In concrete that is subjected to the action of water under head, causing percolation, as in dams and other similar structures, the deterioration is most marked because of the intensity and continuity of the action, and the resulting conditions are correspondingly aggravated.

4. Where freezing temperatures prevail, freezing of the uncombined water which has entered cracks and pores of the concrete, accelerates deterioration because it results in some mechanical breaking up of the concrete. This should be distinguished from disintegration of the

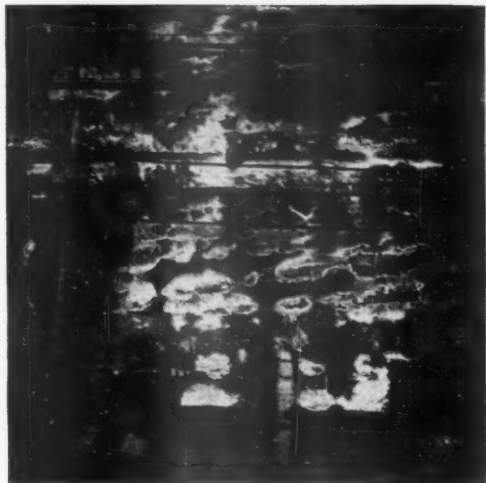


Fig. 1—Incipient Disintegration

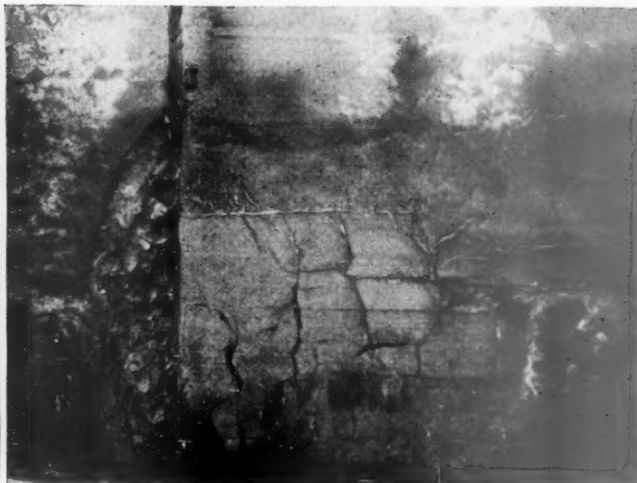


Fig. 2—More Advanced Disintegration

binding cement matrix, which is a breaking down of the inherent physical structure of the cementing medium itself.

5. In all of the concrete samples and structures investigated, in which deterioration occurred under normal service, the aggregate was found to remain sound and unaffected. Disintegration can seldom be traced to the quality of the aggregate. Aggregate that is sound, and which is considered suitable for use in making concrete, usually remains so. In the samples and structures studied, which are believed to be typical, the aggregate was unaffected, but had become loosened in the cement matrix, due to the partial or complete loss of integrity in the binding medium.

6. Too much mixing water produces a more porous concrete and emphasizes work planes and construction joints. Such joints and excess voids, both in number and size, make entrance of contact water easier, and thus, because of more water gaining entrance, the hydrolyzing

action on the cement matrix is accelerated. This action is also probably hastened in such areas, because there is a smaller quantity of hydration products to be hydrolyzed in the original, somewhat diluted mix. But deterioration is still finally due to loss of an inherent property, namely, the binding function of the cement matrix.

7. Assuming that an aggregate of suitable quality in every respect is used, with present cements, and under present conditions, where the concrete in service will be subjected to contact water, disintegration can be controlled to some extent, but not entirely eliminated, by giving careful attention to the details of mixing, and of placing the concrete. These are factors of definite importance in every case, which should not be overlooked, and cannot be ignored or even minimized.

By careful attention to these factors, a more resistant material is obtained and the life of the concrete is prolonged, through retarding the later action of water on the cement matrix. In this sense these factors are



Fig. 1



Fig. 2

Condition of a Bridge Pier Observed at the Age of 10 Years. The Excessive Softening of the Original Binding Material and the Unbound Pieces of Sound Aggregate Are Especially Noticeable. Fig. 1 Is the End of a Pier Such as in Fig. 2

primary contributing causes and of immediate concern.

While these factors are in a large sense fundamental, they should be considered as in the nature of preventive measures, affecting especially the rate of deterioration, if deterioration becomes active, because they control the rate of entrance of the penetrating water.

From the standpoint of the durability of the concrete, the stability of the binding material, however, and what may happen to this binding material, if and when contact water reaches it, is of vital importance. That is, attention to the matters of mixing and placing apparently cannot materially alter qualitatively the inherent binding properties of the cement matrix. Thus, regardless of what causes may accelerate deterioration, the final cause of disintegration is the partial or complete loss of the original cementing properties of this matrix, which results in separation of individual units of the aggregate.

8. The physical structure of concrete not only facilitates deterioration, because the separation of particles and pieces of aggregate is large compared with natural stones, but the large quantity of the products of hydration in concrete, in comparison with the cementitious material in most natural stones, gives a material that is subject to easier attack by later penetrating water than is common in building stones.

9. Concrete is one of the most valuable structural materials when used with good understanding of its limitations as well as appreciation of its very valuable properties and qualities. Like all other important structural materials, however, it has inherent limitations. In many cases deterioration has resulted from the lack of true appreciation of these limitations, that is, this material has been used under improper conditions, conditions where it should have been clear that such deterioration was inevitable.

10. The question may be asked, what can the engineer do, under present conditions, bearing in mind the requirements and uses of concrete in structural work, to prevent the disintegration of concrete? Two methods may be followed, both of which are preventive, rather than complete cures, that is, they depend on preventing contact moisture from reaching the hydrated binding cement matrix during the service of the structure.

(a) By giving careful attention to the proportioning,

mixing, placing and curing methods and processes, the resulting concrete product may be made as nearly impermeable as possible. However, in view of the naturally porous nature of even the best concrete, it is difficult, and the writer believes it to be impossible, to thus obtain a fully satisfactory degree of impermeability. The importance, in all concrete structures, of securing any increase in water-tightness which may be possible, cannot, however, be disputed.

(b) Where contact with moisture is more or less constant, it may be prevented from reaching the vital binding cement matrix, through the use of suitable external waterproofing.

11. Beyond the province of the engineer, what may be done to prevent disintegration of concrete? In short, is it possible for the manufacturer to improve or modify cement as a manufactured product, so that if moisture does reach the hydrated cement binder of the concrete, the resulting products of original hydration will not be broken down, and so that the cement matrix will not lose its original cementing properties, and deterioration thus be retarded? This is obviously a problem which the manufacturer must undertake to solve, if marked progress is to be made in still further retarding the deterioration of concrete in normal service.

Finally, the writer must call attention to the fact that, although he has concentrated attention on the problem of deterioration in concrete, he recognizes that every sample of unsatisfactory concrete which has been studied could be matched with hundreds of examples of concrete which has given excellent and fully satisfactory service. In fact, in some structures where deterioration has occurred, large areas of concrete still appear to be sound and satisfactory. There are, however, too many cases where results do not meet expectations, and the engineer should not be satisfied to leave the problem of deterioration unsolved. Steps must be taken to remove, so far as is possible, the risks of failure, particularly in a material which is as important and is so widely used as portland cement concrete. It was with this viewpoint and in this spirit that he undertook, some 10 years ago, the study which is reported in this bulletin, and which he hopes will contribute to the solution of this important problem.

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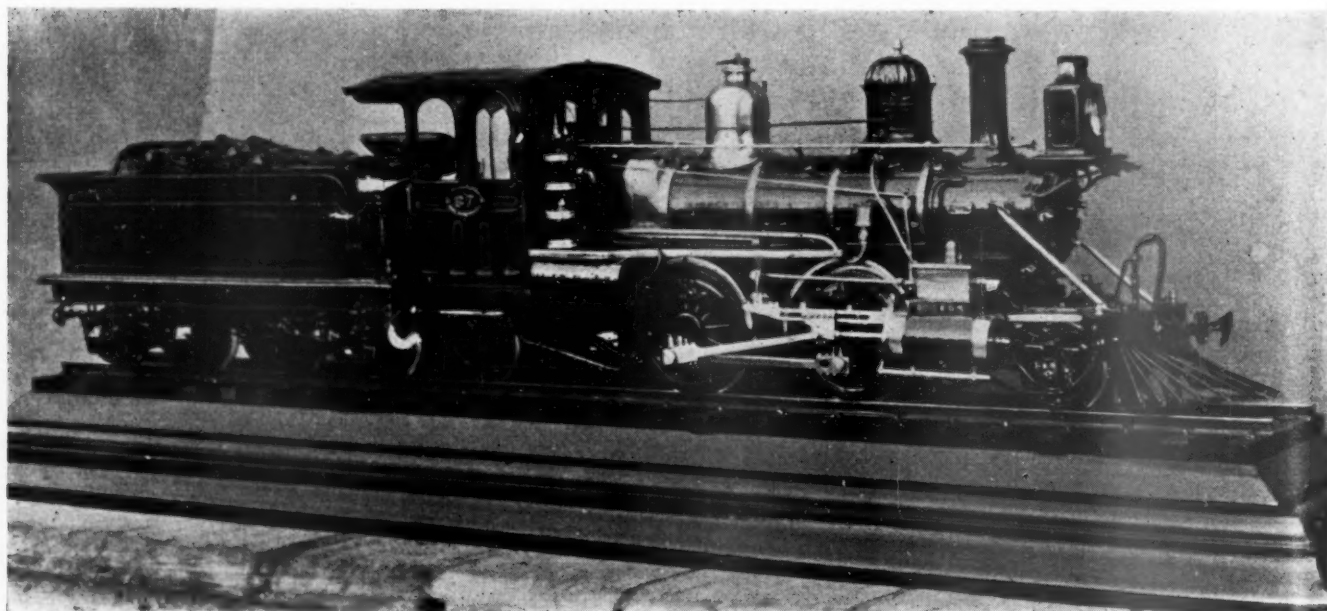


Photo by W. W. Stewart

Model of a "Columbia" Type Locomotive Built for the New Zealand Railways by Rogers in 1877

Operating Local Passenger Trains*

Speeding head-end work, close supervision of branch line operation, and use of buses bring results

PASSENGER travel is now, more than ever before, divided definitely into two classes—through and local. In the past, we have been able to avoid the operation of much strictly local mileage by placing conditional or flag stops on through trains. This has resulted in having neither local nor through service, except in the case of the fast limited trains. The demand for uninterrupted fast through service on the part of the long-haul passenger has made it increasingly difficult to avoid the addition of train-miles to provide for local travel. In fact, the time has apparently arrived when through-schedules must be relieved of local stops, which may mean additional miles, either on the rails or on the highways.

Local passenger-train operation naturally falls into two groups: viz., main line and branch line, the two groups being essentially different. On main lines, the larger towns are usually given service by the through or semi-limited trains, local service being required to serve the smaller towns. On most branch lines there is seldom enough traffic to justify more than one train in each direction, which must necessarily be a local train. On many extremely light traffic branch lines, a mixed train meets the needs for both freight and passenger service, and inasmuch as it is usually possible to maintain fairly dependable schedules on such branch lines, this character of service has proved reasonably satisfactory. Where traffic or other conditions justify a higher grade of service, a Diesel or gas-electric motor car can be operated very economically. On main lines, the use of mixed trains to serve local points is not entirely satisfactory, as generally there is sufficient freight business to render it difficult to maintain schedules which will meet the needs of passenger traffic.

Use of Buses

It has been possible on some roads to work out a closely co-ordinated highway motor coach operation to supplement the rail operations, by which most of the needs for local service can be met at minimum expense and generally without the addition of local train miles. To be of the maximum benefit, such a highway operation should have its schedules so arranged as to fit in with the rail schedules in such a way as to serve best the territory covered. Greater freedom of action is possible when the highway operations are conducted by a separate organization, but this should not be permitted to interfere with the complete co-ordination of rail and highway operations.

During the depth of the depression, traffic and operating officers were inclined to consider local travel as a thing of the past and definitely out of the future trans-

portation picture. The developments of the past two years, with improvements in equipment and reductions in rates, have resulted in a substantial return of local passenger business, and if this improvement is to be made permanent, it is necessary that such service be provided as will most nearly meet the requirements of the various communities served.

Head-End Work

In planning any service to meet the requirements of the smaller communities, consideration must be given to the handling of not only first-class mail, but parcel post and express. In many instances, the public appears to attach more importance to that feature of the service than the actual handling of the passengers themselves. This, in some instances, interferes with the satisfactory handling of branch-line as well as main-line local traffic by motor coach on the highways, as motor coaches, in general, have limited space for mail and express. However, it is possible to meet this situation by providing mail and express compartments, which, while necessarily resulting in a reduction in passenger-carrying capacity, can actually be done without serious impairment of the service, and at reasonable expense.

While the long-haul through passenger traffic undoubtedly offers the greatest prospect of revenue, the short-haul business should not be abandoned. It is not good practice to establish extravagant services to attract the local traffic back to the rails, but by the use of economical methods, a substantial measure of this business can be regained and handled, at least without an actual deficit. When the railroads abandon local passenger business, they lose a most valuable point of contact with the people in the smaller towns, who, after all, are the foundation of our economic structure. It would seem worth while, in order to retain this contact, to devise methods of meeting the needs of these people in the way of local passenger service. There is something of a more personal character connected with serving smaller communities which is not present to the same extent in the fast through service.

Fundamental Principles

Conditions vary, of course, in different sections of the country, and that fact must necessarily be taken into consideration in any study of the local passenger-traffic situation. There are, however, certain fundamental principles which apply generally. The density of traffic varies to a great extent, and different methods will be necessary in a densely populated territory from those which would fit a sparsely-populated section. The extent of availability of paved highways is also an important factor in gauging the extent of highway competition.

Illustrative of the wide range of this subject and the varying conditions, the following is the result of investi-

* Abstracted from a committee report presented before the convention of the American Association of Railroad Superintendents at Chicago on June 9, by a committee of which W. E. Lamb, general superintendent, Missouri Pacific, was chairman.

gations in the extreme east and south and the extreme west. They give an idea of the extent to which conditions and opinions differ.

The Situation in Different Sections

In the east and south, this problem has caused operating officers more concern than any other phase of train operation. In these sections it is regarded as a foregone conclusion that a considerable portion of the short-haul traffic of the railroads is lost to privately-operated automobiles and to buses. This is especially true in the southern country which is sparsely settled. There has been a considerable increase in the number of passengers carried, as well as in earnings, on fast passenger trains, and also great improvement in the equipment used in the local service on southern railroads, but only a small increase in revenue. By co-ordinating rail and highway transportation, where it is possible to do so as an adjunct of bus-rail service, in the more densely populated sections, there is a possibility of regaining considerable of the business which has been lost to private automobiles and buses, but to accomplish this, faster and more frequent schedules, together with the latest type of air-conditioned equipment are necessary.

Train service in the Rocky Mountain area is unique because of the physical geography of the country. Railroads were originally planned and built in this section for the purpose of spanning the great distances between the business centers that were separated by the Rocky Mountain barrier. The sparsely settled country made it desirable to connect the far-distant terminal cities as quickly as possible in order to provide direct routes from the east to the west. The extreme points of the railroad lines became the places of chief interest, and the intermediate points were considered only as they served to facilitate spanning these spaces. The demands of business, the opinions of the public, and the aims of the railroads united in fostering this same purpose. Consequently schedules were planned with the convenience of the extreme points in mind. At that time, cities in this area were not situated closely enough together to create problems of local passenger service. Whatever local business arose was woven into the regular schedules of trains operating between the more distant points. For many years following, the limited amount of local business did not warrant special service.

Following the same trend year after year, the railroads ignored the increasing local passenger business between some of the larger and more closely located cities. Then gradually the need for service was recognized by others; particularly by the electric companies that started a new type of service, offering frequent and rapid runs between two points. The local passenger traffic drifted to these companies and to rival bus companies before the railroads were aware of its volume.

Competitors Left Unchallenged

The volume of the local passenger business increased, as evidenced by the continued activity of the electric lines and short-run bus companies. However, the character of the business available at the present time, as compared with 10 or 15 years ago, shows practically no change. There is still no commuting between cities in this territory as a daily plan of business. The public demand at present is primarily for service between the more distant points. The industrial situation, agricultural conditions and mining activities have not changed in kind but in degree within the last 10 or 15 years in these western states. Consequently, the railroads, for the most part,

have continued to operate under their old schedules, leaving their competitors practically unchallenged.

The railroads still face the same physical conditions in this section of the country and the same primary need for service between the terminal cities exists today. Nevertheless, the railroads are gradually gaining enough local passenger traffic to warrant special train service between a few of the cities that are somewhat closer together. The companies are becoming more and more alert to this source of business and are planning for it. However, in most instances, local passenger service is still considered secondary to through train service. The local stops must be made to conform to the through schedule, and time convenience can be considered only for the terminal points.

Public Relations

The railroad personnel must do its share in strengthening good will. The personal contacts of the railroad are made through the ticket agents, station masters, conductors, brakemen, porters and others. These are the vital contacts, the points at which friends are finally gained or lost for the company. Regardless of the cost, the safety, and the convenience of a railroad, the passengers will remember the human relationships and the treatment they received.

The duties of the railroad employees are of the character that demands unusual judgment, tact and courtesy. The safety of the passengers and the reputation of the railroad are dependent largely upon the way they exercise their duties. Certainly the grouchy person who shouts at the passengers with no thought of courtesy has no place in serving the public. The problem of personnel is of equal importance on the short run as on the through schedule.

Conclusion

What can the railroads offer as a challenge to their competitors in an effort to regain local passenger traffic today? Already, they are answering this question, and the answer has come from considering the favorable advantages which their competitors have, i.e.: the less expensive rates of the buses, the speed and relative cleanliness of the electric lines, the ease and comfort of the private automobile.

Almost simultaneously, railroads became active in improving their equipment and in reducing rates to the public. Lowered fares have started to attract persons to the services the railroads are offering; and they are being attracted by the rates, they are being held by the new comforts afforded them. The ease of the private automobile is being excelled in the air-conditioned, sanitary coaches and in the observation lounges equipped with radios. The reduced dining-car rates and the special meal service in the coaches are meeting a public demand. The convenient schedules of the electric lines and buses are being rivaled in many places, and their speed and cleanliness are being outstripped.

The mechanical safety of the railroads has been established, as shown by the excellent records, and as a result, the good will of the public has been won. Machine failures have been minimized. The railroad as a machine is satisfying the public by its efficiency. The railroads have improved their conditions until at present they can more nearly meet the local traffic problems than ever before. They will continue to meet the problem as it exists, by affording a service that is cheap, safe, convenient and courteous, and consequently a service that will become increasingly more valuable to the public and to the railroads.

Loomis of the Lehigh Valley Dies

Recently elected chairman, the former L. V. President met the problems of anthracite carriers during war and depression

EDWARD EUGENE LOOMIS, chairman of the board and former president of the Lehigh Valley, died at the age of 72 on the afternoon of July 11, at his summer home, Holiday Farms, in Murray Hill, N. J., after a six-day illness. Funeral services were held at Holiday Farms and at Mrs. Loomis' family home in Elmira, N. Y.

Holder of the degree of LL.D. from Lafayette College, Mr. Loomis devoted his business career almost exclusively to railroading and affiliated coal production interests, and remained in the battleground of rail transportation until his recent illness. Even after relinquishing the presidency of the Lehigh Valley to his former assistant, Duncan J. Kerr, in May (reported in the *Railway Age* for May 8, page 792), Mr. Loomis continued to serve the road as chairman of its directorate and to devote his energies to the welfare of the collective body of carriers as chairman of the Committee on Public Relations of the Eastern Railroads.

As well, when illness overtook him, he was still contributing to industrial and commercial life as director of many important companies, including the Great Northern, the American Can Company and the American Telephone & Telegraph Company; he served also as trustee of the American Surety Company.

He began his railroad career in the office of the attorney for the Denver & Rio Grande in 1883. Returning to the East in 1884, he advanced in the service of the Erie system through clerical positions in the general superintendent's office to attain the superintendency of the Tioga division in 1894, when he was still below the 30-year-old mark. In 1899 he took over for a brief six months' period the superintendent's post of two Erie affiliates—the New York, Susquehanna & Western and the Wilkes-Barre & Eastern, whence he interrupted direct railroad operating service to tackle the supplementary problems of the eastern anthracite carriers as superintendent of the Delaware, Lackawanna & Western's coal mining operations.

It was in this latter capacity that Mr. Loomis came into direct contact with the peculiar problems of the anthracite industry, especially in labor relations, and his capable direction of affairs during the great coal strike of 1900, which threatened to spread through the entire fuel field, undoubtedly tempered him for the troublous days of the great war, when, as the newly-elected president of the Lehigh Valley, a major anthracite carrier,



Edward E. Loomis

he faced the battery of strikes, labor shortages, and coal tie-ups which made the coal roads objects of the nation's concern. His success in the task of 1900 was probably the basis of his selection as senior vice-president of the Delaware, Lackawanna & Western organization in 1902, and the reputation he gained in the trying period of the war as head of the Lehigh Valley established him as one of the country's best-known railroad executives.

When the roads were returned to private ownership at the end of the war period, Mr. Loomis was faced with particularly difficult rehabilitation problems, since his railroad had been severely taxed in facilities and had, consequently, developed considerable under-maintenance. Decreases in the anthracite market and successive labor troubles in the mines only served to retard his plans. Nevertheless, with persistent effort he built up the road's physical equipment and diversified its traffic, with particular emphasis on the purchase of high-speed freight power

and the development of scheduled merchandise service to decrease the degree of its dependence upon the state of the coal market.

Spokesman for Eastern Carriers

As spokesman for the eastern carriers in his chairmanship of the Committee on Public Relations, as well, Mr. Loomis successfully met the challenge of the post-war and depression.

He participated with enthusiasm in the task of developing a better public understanding of railroad problems and until his death fought the threat of intensification of government domination. To him also, fell a large share in the task of formulating policies to check governmental subsidy of inland waterways and to effect regulation of competitive forms of transport. During the recent depression period, he promulgated a plan seeking to afford the carriers relief from burdensome taxes and forced expenditures, such as in grade-crossing elimination, and on his own road instituted a "share the work" plan, comprising split runs for train-service employees along with a three-day week for yard and terminal-service men.

At the stroke of 12 noon, on July 14, at the time of Mr. Loomis' burial at Elmira, all operations on the road he served were interrupted for a two-minute period of silence.

Railroad Construction Indices for 1936

WASHINGTON, D. C.

THE Bureau of Valuation of the Interstate Commerce Commission, has issued its revised compilation of railroad construction indices covering the year 1936. Taking 1910-1914 cost as 100, the index for

the year 1936 for the railroads as a whole is 143. The peak was reached in 1920 when the index reached 226; the valley was penetrated in 1932-33 when the index sank to 133. Construction items in which manual labor has been largely supplanted by mechanical, have shown receding costs in recent years, though there has been a slight increase in these accounts largely attributable to higher wages, from the valley of 1933. Notable among
(Continued on page 80)

REGIONS I TO VIII, Inclusive

Tabulation of Indices by Years and by Accounts Applicable to the Entire United States

		ROAD																							
Acct.	*Per Cent	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936		
1	2.83	101	110	134	159	178	214	175	157	171	171	166	166	164	161	160	152	143	131	127	131	131	133		
3	18.19	100	110	130	165	190	250	170	143	160	164	149	153	143	135	133	123	118	106	98	100	101	99		
4																									
5	1.51	103	109	128	150	183	208	179	165	179	179	179	178	169	155	155	143	130	119	111	122	120	125		
6	9.41	105	111	146	162	178	206	165	160	176	173	171	170	168	164	163	150	134	122	122	136	135	141		
7	0.04	102	124	169	177	184	210	150	153	173	171	168	165	163	163	162	154	144	129	122	136	136	137		
8	5.58	100	100	112	133	170	201	189	157	177	175	172	173	175	176	175	170	155	144	139	149	147	150		
9	8.57	101	106	121	148	152	168	158	144	145	145	144	144	144	144	144	144	144	140	134	123	123	124		
10	3.39	99	129	198	210	203	209	192	161	182	179	177	177	177	177	177	177	169	165	163	158	150	147		
11	4.09	103	107	114	140	150	207	191	176	175	175	174	175	176	176	176	168	159	146	146	141	139	140		
12	4.35	100	100	130	163	175	218	174	165	188	188	188	188	188	188	188	182	175	164	157	159	165	165		
13	0.51	100	122	142	178	194	204	189	177	179	179	176	175	175	175	173	171	164	147	135	140	140	140		
14	0.08	103	108	119	165	199	280	197	194	212	200	201	201	204	204	204	198	188	125	126	140	140	140		
15	1.18	104	108	137	161	182	208	171	164	178	175	171	169	166	165	165	161	153	131	127	139	137	139		
16	4.42	101	115	135	154	185	215	192	180	194	193	188	184	189	188	187	182	165	141	145	151	151	157		
17	0.51	100	115	136	156	185	216	192	178	196	196	189	187	192	191	190	186	166	140	145	150	150	150		
18	0.82	101	120	159	170	191	213	185	178	187	187	186	182	185	186	184	177	161	147	151	155	155	156		
19	0.26	101	120	153	160	190	212	181	166	185	185	182	180	183	183	183	174	159	144	149	154	154	153		
20	2.16	102	118	141	159	188	216	191	180	193	192	188	185	189	188	187	176	161	137	142	147	147	155		
21	0.09	100	110	128	150	185	214	190	184	197	197	193	190	195	193	193	182	165	137	142	147	147	156		
22	0.04	100	115	135	155	185	210	193	178	198	198	193	189	193	191	191	184	165	137	142	147	147	154		
23	0.53	100	114	133	152	178	204	167	158	175	175	174	177	178	178	178	172	158	136	141	146	146	149		
24	0.44	101	117	145	155	184	204	170	159	176	176	174	174	176	176	176	172	157	136	142	147	147	151		
25	0.01	108	122	148	175	194	213	194	176	188	189	186	185	188	189	189	178	163	145	148	176	176	178		
26	0.34	103	124	147	158	164	192	191	162	187	179	163	157	163	165	165	150	138	121	119	124	128	131		
27	1.49	94	106	132	152	165	175	163	158	165	164	162	169	158	155	154	147	138	130	130	133	136	138		
28	0.01																						151		
29	0.14	104	122	141	158	189	218	197	184	196	196	191	186	191	191	189	177	162	138	143	148	148	152		
30	0.01	101	117	137	156	187	218	194	180	197	197	192	188	193	191	190	176	161	137	142	147	147	138		
31	0.03	115	166	190	181	186	176	145	132	142	136	140	141	137	142	150	136	116	98	98	103	105	108		
32	0.51	109	148	178	192	189	205	172	163	178	172	175	176	175	178	181	173	148	144	144	148	151	152		
33	0.06	106	116	145	169	194	230	208	179	209	203	185	183	198	199	209	200	172	147	147	150	153	148		
34	0.01	101	110	119	172	206	250	228	214	220	215	220	216	219	219	217	215	175	175	175	180	184	185		
35	0.04	101	117	137	156	186	217	192	179	195	195	190	186	191	190	189	182	164	141	146	151	151	154		
36	0.03	104	124	153	177	205	217	191	190	191	191	191	190	190	190	190	190	181	156	150	145	145	145		
37	0.08	105	113	127	146	158	170	162	149	151	151	151	151	151	149	148	147	144	138	138	147	147	149		
38	0.05	100	100	109	179	179	184	202	181	170	173	185	190	190	191	191	190	160	155	155	150	150	160		
44	0.95	115	126	155	192	200	210	198	173	183	185	185	186	187	189	191	176	166	155	155	179	179	179		
45	0.26	115	126	155	192	200	210	198	173	183	185	185	186	187	189	191	176	166	155	155	179	179	179		
46	0.07	115	126	155	192	200	210	198	173	183	185	185	186	187	189	191	176	166	155	155	155	150	145		
Wtd. Ave. 1-46	73.09	101	110	134	159	178	214	175	157	171	171	166	166	164	161	160	152	143	131	127	131	131	133		
		EQUIPMENT																							
Acct.	*Per Cent	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936		
51	5.42	86	102	145	189	202	248	192	179	197	185	171	191	190	179	188	194	184	168	166	176	188	188		
52	0.10	100	117	137	184	184	217	197	196	198	199	192	194	202	203	221	221	210	175	165	185	190	190		
53	11.22	101	148	183	243	267	284	184	156	200	179	171	163	178	169	185	181	161	144	144	165	177	178		
54	2.14	89	104	132	164	197	213	169	152	192	187	183	189	191	180	183	181	178	161	161	173	182	182		
55	0.02	89	104	132	164	197	213	169	152	192	187	183	189	191	180	183	181	178	161	161	173	182	182		
56	0.48	107	125	164	227	245	239	200	175	170	170	170	170	170	170	170	165	158	148	148	158	160	160		
57	0.56	96	128	165	225	244	263	193	168	203	183	188	180	192	184	195	191	178	165	165	177	180	180		
58	...	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		
Wtd. Ave. 51-58	19.94	96	130	166	219	240	265	185	163	198	182	173	174	183	174	186	185	170	153	153	169	180	181		
		GENERAL EXPENDITURES																							
71-75 & 77	*Per Cent	101	110	134	159	178	214	175	157	172	171	166	166	164	161	160	152	143	131	127	131	131	133		
76	6.08	102	111	135	161	181	216	176	158	171	172	167	167	165	162	161	153	144	132	128	132	132	134		
Wtd. Ave. 71-77	6.97	102	111	135	161	181	216	176	158	172	172	167	167	165	162	161	153	144	132	128	132	132	134		
1-46	73.09	101	110	134	159	178	214	175	157	171	171	166	166	164	161	160	152	143	131	127	131	131	133		
51-58	19.94	96	130	166	219	240	265	185	163	198	182	173	174	183	174	186	185	170	153	153	169	180	181		
71-77	6.97	102	111	135	161	181	216	176	158	172	172	167	167	165	162	161	153	144	132	128	132	132	134		
Wtd. Ave. 1-77	100	100	115	142	173	193	226	177	159	177	174	168	168	169	164	166	160	149	136	133	140	142	143		

* The percentages shown are the relationship in dollars of each individual account to the total of Accounts 1 to 77, inclusive, except Account 2—Land, and were arrived at by taking 1910-14 dollars from the basic engineering reports with varying dates of valuation from 1914 to 1921, inclusive.

Resistance of Lightweight Passenger Trains*

Factors affecting the resistance of modern lightweight stream-line trains presented in a more practical form than heretofore available

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FOR many years there was little information available in a concrete form, for the guidance of transportation engineers, in the matter of tractive resistance of locomotives and cars of various types and weights. About ten years ago W. J. Davis, an engineer of the General Electric Company, correlated the various sources of information and issued a treatise¹ which subsequently became the recognized authority on this important subject. Although Davis' formulas relate specifically to electric locomotives, nevertheless they are susceptible of application to steam engines by segregating the losses peculiar to this type of motive power.

It is the intention of the author to draw freely from Davis' contributions¹ on the general subject and also from an article by DeBell and Lipetz² which deals specifically with air-resistance components. As a matter of fact, it is not the intent to introduce any new fundamental data in this paper, but to merely condense into more practical form, for universal application, the researches of other engineers along the lines in question.

There appears to be no reason for departing from Davis' original segregation of train-resistance factors, which may be summarized as follows:

- (a) Those that are constant with respect to speed, R_1 .
- (b) Those that vary as the first power of the speed, R_2 .
- (c) Those that vary as the square of the speed, R_3 .

For convenience in discussion, these three factors will be separately treated under the following subjects.

Track and Journal Resistance

According to the Davis formulas, these elements are covered by a fixed and a variable component, the latter being inversely affected by individual axle loadings. Based upon Schmidt's³ experiments these factors were expressed as

$$\text{Unit resistance per ton} = 1.5 + (100/W)$$

where W represents the entire weight in tons on four axles. The modification in the Davis formulas shows

$$\text{Unit resistance per ton} = 1.3 + (29/w)$$

where w represents the weight per axle in tons. The

* Abstract of a paper which was presented at the semi-annual meeting of the American Society of Mechanical Engineers held in Detroit, Mich., May 17 to 21, 1937, and published in the May, 1937, issue of the A.S.M.E. Transactions.

¹ "Traction Resistance of Electric Locomotives and Cars," by W. J. Davis, Jr., General Electric Review, October, 1926, pages 685-708.

² "Air Resistance of Passenger Trains," by J. W. DeBell and A. I. Lipetz, Railway Mechanical Engineer, December, 1935, pages 496-502.

³ "Passenger-Train Resistance," by E. C. Schmidt and H. H. Dunn, Engineering Experiment Station, Bulletin No. 110, University of Illinois, Urbana, Ill.

differential, as between these authorities, results in the following:

60-ton car	{	Schmidt $1.5 + \frac{100}{60} = 3.17$ lb. per ton
		Davis $1.3 + \frac{29}{15} = 3.23$ lb. per ton
30-ton car	{	Schmidt $1.5 + \frac{100}{30} = 4.83$ lb. per ton
		Davis $1.3 + \frac{29}{7.5} = 5.17$ lb. per ton

Thus, the unit resistance, as between the two formulas shows decreases of the order of 34.5 to 37.5 per cent for an increase in the car weight of 100 per cent.

Apparently no attempt has been made to segregate the components of rolling resistance, track resistance, and journal friction, although it would appear that the value of journal friction might be established independently of the other elements, through the medium of stand tests. Furthermore, it seems, that while the unit of journal resistance will vary more or less inversely with the weight per axle, the rolling resistance, for a given rail weight, will vary to some extent directly with the axle loading.

The tendency is ever prevalent toward larger rail sections, and the lightweight equipment, now under discussion, has materially lower axle loadings and consequently wheel pressures. Both of these elements act in the same direction, pointing to a decrease in track resistance occasioned by the so-called "wave action." This feature is emphasized in tests on the Kansas City Southern Railway,⁴ conducted in 1930, which showed a reduction of 0.4 lb. per ton with identical axle loadings, but with the rail weight increased from 84 to 150 lb. per yard.

These mentioned tests⁴ indicate a resistance decrease of 0.1 lb. per ton for a rail-weight increase of 19.7 per cent, consequently it may be reasonably assumed, that a corresponding reduction in axle loading, with a constant rail weight, will produce similar results.

The tendency in lightweight equipment indicates a reduction in unit axle loading of about 17 per cent for locomotives and from 12 to 25 per cent for cars to operate on existing tracks. While it would therefore seem proper to make some reduction in the first group of the Davis formulas for the reasons herein cited, it

⁴ "What is the Economic Weight of Rail," *Railway Age*, vol. 82, May 24, 1930, pp. 1231-1237.

is not believed that the information at hand is sufficiently conclusive to warrant such action.

The advent of roller-journal bearings on rolling stock does not appear to have a material effect on the resistance units involved, although it is fully recognized that the initial starting resistance is thereby reduced materially as compared to A.A.R. brass journal bearings. Some opinions and tests controvert this statement.

After giving due consideration to all of the more definite information on the subject, it is decided to maintain the Davis factor as uniformly applicable to both roller-bearings and journal brasses. The final components for R_1 thus become

$$R_1 = 1.3 + \frac{29}{w} \dots \dots \dots [1]$$

where w = weight per axle in tons.

Flange Resistance

The term "flange resistance" shall include all forms of resistance proportional to the first power of the speed. These also embrace, in general, flange friction, resistance elements due to concussion, swaying, and oscillation. It is obvious, that the character of track construction, truck-wheel spacing, the use of truck restraining devices, and other items of lesser import are controlling factors in the constant to be employed.

In Davis' analysis of this problem there are established constant values varying from 0.03 to 0.09 depending upon the type of service considered. These constants are as follows:

Locomotives (electric)	0.030
Passenger cars (4 or 6 axle)	0.030
Freight cars (4 or 6 axle)	0.045
Multiple-unit cars (4 axle)	0.045
Interurban cars (operated singly)	0.090

The high value of 0.09 was used only for single-car operation, where oscillations, etc., are naturally magnified without the restraining influence exercised by a connected train.

The lightweight high-speed equipment considered in this analysis will consist of locomotives or power units weighing from 75 to 250 tons in combination with lightweight four-axle or articulated cars.

There is no question but that the locomotives or power units should be placed in the category where the 0.03 constant applies. The relatively lightweight trailing cars will have comparatively short truck-axle centers. As an offsetting feature, however, the highest grade type of construction, probably with truck-stabilizing features, is employed. In addition, high-speed operation is of necessity conducted over a well-maintained right of way, with the resultant oscillating features held to a minimum. Furthermore, the recent practice of flat turning the tire treads gives every indication of materially reducing flange contact and pressure on the rail head when operating on tangent track.

For all of the reasons cited in the foregoing paragraph, it is decided to maintain the present minimum factor for both locomotives or power units and the trailing cars. The constant therefore remains as

$$R_2 = 0.03 \ V \dots \dots \dots [2]$$

where V = speed, m.p.h.

Air Resistance

Air resistance, in effect, covers not only head-end resistance but all air elements, including those pertaining to such factors as turbulent or eddy currents, skin friction, ground wind, and viscous drag. It is generally assumed that such resistance varies as the square of

the speed which, while not entirely true, is sufficiently accurate for all practical purposes.

The Davis formulas apparently took cognizance of the fact that a more or less definite relationship existed between the cross section, weight, and length of the individual car units, which accorded automatic compensation for skin effects. Thus, he used the head-end area in combination with a proper constant for establishing total air resistance and divided the resultant, so derived, by the weight of each individual car or locomotive for the purpose of obtaining the unit resistance expressed as pounds per ton.

The later use of aluminum and high-tensile steel alloys, disturbed the previously mentioned equilibrium so that the principal authorities on this particular subject now deem it best to take the cross-sectional area or perimeter of the locomotives or cars, in combination with the length, for securing total air-resistance values.

Streamline effects were considered by Davis, but not extended to the formulas or curves in which his studies culminated. Based upon tests made in St. Louis by the Electric Railway Test Commission, he established the following coefficient percentages for the body only, with different forms of vestibule constructions, which presumably applied to both ends of the individual car as tested. These are as follows:

Flat	100 per cent
Standard (truncated wedge)	67 per cent
Parabolic	35 per cent
Parabolic wedge	33 per cent

It was ascertained that the single car, used in the previously mentioned St. Louis tests, produced a coefficient of air resistance of 0.00228, which was magnified to 0.0024 in the Davis formulas. If the ends of the car had been of parabolic shape, but without other changes, then the coefficient as applied to the head-end cross-section and the V^2 , would become 0.001495.

In recent years, through the medium of wind-tunnel tests, considerable data have been collected, especially for airplanes and streamline-train resistances which are of value in the determination of R_3 or the third factor of the train-resistance formula. This whole subject is well presented by DeBell and A. Lipetz,² and by Ober.⁵

It is obvious, that the selected shape of the head and rear end of the train, as well as many other details of design, which may be influenced by factors other than those attributable solely to air-resistance features, will have some effect on the final resistance units that will apply. These variables are represented by the symbol K in formulas to follow. Open-skirt construction (18 in. from skirt to top of rail) or closed-skirt construction, where the entire underframing is shrouded, are elements which must also be considered. The relative constants for these last two alternative methods of construction on power cars, as defined by DeBell and Lipetz,² is 0.00224 for open skirts, 0.002 for closed skirts; the decrease for closed skirts is therefore 0.00024 or 10.75 per cent.

The K factors, as ascertained from the tests, are as follows:

- K_1 = For power or leading-car nose well streamlined = 0
For nose bluntly streamlined = $0.000036 \times$ cross-sectional area of nose at full section, including trucks, in square feet
- K_2 = For tail shape of rear car well streamlined = 0
For tail bluntly streamlined = $0.000061 \times$ cross-sectional area of tail at full section, including trucks, in square feet
- K_3 = For power-car trucks, both faired = 0
For unfaired trucks = 0.00026
- K_4 = For faired trailing-car trucks = 0
For unfaired trucks = $0.00013 \times$ number of trailing-car trucks
- K_5 = For smooth diaphragms = 0
For cowed diaphragms = $0.000037 \times P_e \times$ number of diaphragms

⁵ "Air Resistance of the Burlington 'Zephyr,'" by S. Ober, *Railway Gazette*, Supplement, June 14, 1935, p. 1184.

- K_6 = For no bulge of power car = 0
 For bulge of good streamline shape = $0.00032 \times$ cross-sectional area of bulge in square feet
 For bulge of relatively poor streamline shape = $0.00051 \times$ cross-sectional area of bulge in square feet
 K_7 = For closed wheel shrouds on streamlined locomotives (all wheels completely enclosed) = 0
 For open shrouds (2 ft. \times 2 ft. 6 in. inspection openings over the driving-wheel journals) = $0.0005 \times$ total number of openings
 For short shrouds (driving wheels and tender trucks completely exposed) = 0.0182
 K_8 = For helmet nose on streamlined locomotive = 0
 For straight nose = 0.0021
 For round nose = 0.0026
 K_9 = For round-top boiler shape on streamlined locomotive = 0
 For cowl top (domes and fittings enclosed in longitudinal cowl above boiler shroud) = 0.0035

For the purpose of this analysis and in order to present some examples showing the adaptation of the DeBell and Lipetz² formulas, the following three basic types of equipment are selected:

1—The streamlined locomotive-hauled train with open-skirt streamlined cars, having (a) no adverse design elements and (b) maximum adverse design elements.

2—The streamlined locomotive-hauled train with standard cars, having (a) no adverse locomotive-design elements and (b) maximum adverse locomotive-design elements.

3—The streamlined power-unit articulated train with closed skirts, having (a) no adverse design elements and (b) maximum adverse design elements.

For the first case, a streamlined electric, Diesel-electric, or steam locomotive with a train of lightweight streamlined cars is assumed. The simplified formula, as established by DeBell and Lipetz,² is

$$R_s = (0.023 \sqrt[3]{L_L + K_L}) + \left[0.001735 P_c \left(\frac{L_c}{100} \right)^{0.88} + K_c \right] V^2 \dots [3]$$

where L = length of train, ft.; L_L = length of locomotive or locomotive and tender, ft.; L_c = length of car consist (rear of locomotive or tender to rear of train), ft.; P_c = perimeter of cars from plane of top of rails over car to plane of top of rails, ft.; and K_L and K_c = constants based upon details of construction.

The constants for the locomotive resistance presuppose a cross-sectional area equivalent to that of the New York Central Hudson-type steam locomotive which is a fair average for all locomotives considered for the particular type of service now analyzed. The individual formula for the locomotive, reduced to a unit basis, expressed in pounds per ton is

$$R_s = \frac{(0.023 \sqrt[3]{L_L + K_L}) V^2}{W} \dots [4]$$

and for the cars (14 ft. high from top of rail to roof, 10 ft. wide, and with an effective perimeter of 40 ft.), expressed in pounds per ton is

$$R_s = \frac{\left[0.0694 \times \left(\frac{L_c}{100} \right)^{0.88} + K \right] V^2}{W} \dots [5]$$

where W = total weight of locomotive or cars, tons.

For the second case a streamlined electric, Diesel-electric or steam locomotive with a train of standard vestibuled cars is assumed. The simplified formula is

$$R_s = (0.023 \sqrt[3]{L_L + K_L}) + \left[0.0031 \times P_c \left(\frac{L_c}{100} \right)^{0.7} + K_c \right] V^2 \dots [6]$$

The locomotive formula for unit resistance remains as in the first case, that is, Equation [5].

The following substitution, expressed in pounds per ton applies to the cars

$$R_s = \frac{\left[0.124 \left(\frac{L_c}{100} \right)^{0.7} + K \right] V^2}{W} \dots [7]$$

For case No. 3, the train hauled with a power unit is treated as a whole upon the basis of the formula

$$R_s \left[0.0020 P_c \left(\frac{L}{100} \right)^{0.8} + K \right] V^2 \dots [8]$$

The cross-section areas for trains of this character are somewhat less than that for the locomotive-hauled trains previously considered. The distance from top of rail to roof is now taken as 12 ft. and the width as 9½ ft., thus producing a perimeter of 35 ft. On this basis the unit formula expressed in pounds per ton, may be simplified somewhat as

$$R_s = \frac{\left[0.07 \left(\frac{L}{100} \right)^{0.8} + K \right] V^2}{W} \dots [9]$$

The application of the suggested formulas to hypothetical train compositions is shown as follows, based upon certain assumptions, as defined along the lines of recent developments.

Example—Case No. 1

Consider a locomotive with a weight of 200 tons, a length of 80 ft., and eight axles. The train consists of ten 50-ton, 70-ft. cars with four axles per car, assume a train speed of 90 m.p.h.

IDEAL DESIGN

The resistance of the locomotive is

$$\begin{aligned}
 R &= 1.30 + \frac{29}{w} + 0.03 V + \frac{(0.023 \sqrt[3]{L_L + K}) V^2}{W} \\
 &= 1.30 + 1.16 + 2.70 + \frac{(0.023 \times 4.3 \times 8100)}{200} \\
 &= 9.17 \text{ lb. per ton}
 \end{aligned}$$

The resistance of the cars is

$$\begin{aligned}
 R &= 1.30 + \frac{29}{w} + 0.03 V + \frac{\left[0.0694 \left(\frac{L_c}{100} \right)^{0.88} + K \right] V^2}{W} \\
 &= 1.30 + 2.32 + 2.70 + \frac{(0.0694 \times 5.54 \times 8100)}{500} \\
 &= 12.55 \text{ lb. per ton}
 \end{aligned}$$

The resistance for the locomotive and car is

$$\begin{aligned}
 R &= \frac{(9.17 \times 200) + (12.55 \times 500)}{700} \\
 &= 11.58 \text{ lb. per ton}
 \end{aligned}$$

The horsepower output at the wheels for balanced speed on level tangent track is

$$\frac{11.58 \times 700 \times 90}{375} = 1945 \text{ hp.}$$

ADVERSE DESIGN

The resistance of the locomotive is

$$\begin{aligned}
 R &= 1.30 + 1.16 + 2.70 + \frac{(0.023 \times 4.3 + 0.0243) 8100}{200} \\
 &= 10.16 \text{ lb. per ton}
 \end{aligned}$$

For the cars

$$R = 1.30 + 2.32 + 2.70 + \frac{(0.0694 \times 5.54 + 0.015)8100}{500}$$

$$= 12.79 \text{ lb. per ton}$$

For the locomotive and cars

$$R = \frac{(10.16 \times 200) + (12.79 \times 500)}{700}$$

$$= 12.05 \text{ lb. per ton}$$

The horsepower is

$$\frac{12.05 \times 700 \times 90}{375} = 2024 \text{ hp.}$$

Example—Case No. 2

The conditions for this case are the same as for case No. 1, except with standard vestibuled 70-ft. cars.

IDEAL DESIGN

For the locomotive

$$R = 1.30 + \frac{29}{w} + 0.03 V + \frac{(0.023 \sqrt[3]{L_L + K}) V^2}{W}$$

$$= 1.30 + 1.16 + 2.70 + \frac{(0.023 \times 4.3 \times 8100)}{200}$$

$$= 9.17 \text{ lb. per ton}$$

For the cars

$$R = 1.30 + \frac{29}{w} \times 0.03 V + \frac{\left[0.124 \times \left(\frac{L_c}{100} \right)^{0.7} + K \right] V^2}{W}$$

$$= 1.30 + 2.32 + 2.70 + \frac{(0.124 \times 3.904 \times 8100)}{500}$$

$$= 14.17 \text{ lb. per ton}$$

For the locomotive and cars

$$R = \frac{(9.17 \times 200) + (14.17 \times 500)}{700}$$

$$= 12.73 \text{ lb. per ton}$$

The horsepower output at wheels for balanced speed on level tangent track is

$$\frac{12.73 \times 700 \times 90}{375} = 2140 \text{ hp.}$$

ADVERSE DESIGN

For the locomotive

$$R = 1.30 + 1.16 + 2.70 + \frac{(0.023 \times 4.3 + 0.0243)8100}{200}$$

$$= 10.16 \text{ lb. per ton}$$

For the cars

$$R = 1.30 + 2.32 + 2.70 + \frac{(0.124 \times 3.904)8100}{500}$$

$$= 14.17 \text{ lb. per ton}$$

For the locomotive and cars

$$R = \frac{(10.16 \times 200) + (14.17 \times 500)}{700}$$

$$= 13.02 \text{ lb. per ton}$$

The horsepower output is

$$\frac{13.02 \times 700 \times 90}{375} = 2187 \text{ hp.}$$

Example—Case No. 3

Consider a power unit articulated with a three-car (eight axles) 120-ton train 198 ft. long. Assume a speed of 90 m.p.h.

IDEAL DESIGN

The train resistance is

$$R = 1.30 + \frac{29}{w} + 0.03 V + \frac{\left[0.07 \times \left(\frac{L}{100} \right)^{0.8} + K \right] V^2}{W}$$

$$= 1.30 + 1.94 + 2.70 + \frac{(0.07 \times 1.727 + 0.015) 8100}{120}$$

$$= 14.10 \text{ lb. per ton}$$

Horsepower output at wheels for balanced speed on level tangent track is

$$\frac{14.10 \times 120 \times 90}{375} = 406 \text{ hp.}$$

ADVERSE DESIGN

The train resistance is

$$R = 1.30 + 1.94 + 2.70 + \frac{(0.07 \times 1.727 + 0.015) 8100}{120}$$

$$= 15.12 \text{ lb. per ton}$$

The horsepower output is

$$\frac{15.12 \times 120 \times 90}{375} = 435 \text{ hp.}$$

Natural or Ground Winds

The foregoing analysis of train resistance is based upon a still air condition, with the third factor of the equation $[R_3]$ derived from wind-tunnel tests where the flow of air is parallel to the position of the train. This in effect is symbolical of actual operation, where the relative pressures and consequently the resistance elements are created only by the movement of the train itself.

It has been more or less customary in the past when considering wind conditions to assume that the maximum retarding elements were occasioned by a direct head wind and that the force of such wind should be added to the train speed, expressed in the same units, for the determination of resultant values. For example, a train speed of 60 m.p.h. and an adverse wind of 20 m.p.h. would affect the third value of the equation as follows:

$$\begin{array}{l} \text{No wind} \dots\dots\dots 60^2 = 3600 \\ \text{20 m.p.h. head wind} \dots\dots\dots (60 + 20)^2 = 6400 \end{array}$$

which represents 6400/3600, or 1.77 times the normal drag.

DeBell⁶ has given test results which indicate the effect of aerodynamic forces brought about by extraneous wind currents, and has established the value thereof at different directional angles by placing the test model obliquely to the air stream. It was thus ascertained that the maximum adverse condition was obtained when the counterbalancing air pressure was in the forward quartering position, at an angle of between 40 deg. and 50 deg. to the direction of movement. These ground-wind currents apparently exercise an adverse effect from zero angle, representing a direct head wind, to an angle of 120 deg. or more. An advantage is reflected from this point to a direct tail wind. As expressed in a relationship to the square of the combined train speed and head wind, the increase in resistance value of the 40 deg. to

⁶ "Effect of Natural Winds on Air Drag," by G. W. DeBell, *Railway Mechanical Engineer*, April 1936, pp. 145-147.

50 deg. forward quartering wind is of the order of 1.25 when the wind velocity is equivalent to one third of the train speed and 1.50 when the wind velocity equals the train speed.

The foregoing remarks under this subject are of more or less academic interest, because from a practical standpoint the wind varies from all directions and at different intensities, although for any given trip it is necessary to reckon upon some character of adversity which can be estimated as the square of the total, that is (train speed + wind velocity)². For extreme accuracy, weather-bureau records can be obtained for the territory considered. As this paper is concerned more with the application of figures for general use, it is believed that the equivalent of a direct head wind of 10 m.p.h. should be taken as a practical value for schedule calculations.

Quartering, or direct side winds, also affect flange friction R_2 and possibly, to a minor extent, journal friction R_1 due to pressure on end thrust bearings. These elements have not been considered in this analysis, due to lack of information on the subject.

Track Curve Resistance

The unit of track curve resistance appears to be uniformly established at 0.8 lb. per ton per deg. This must be considered in train-resistance calculations. The alignment of the road in question must be studied, the radius of each curve multiplied by its length and the total of the resultants divided by the total length, including tangent track, of the particular section being analyzed. The average degree of curvature and the corresponding unit train resistance will be thus obtained.

Air Conditioning and Lighting

The introduction of air conditioning on railroad cars, produces a power requirements element of considerable proportions which in many cases must be converted into train-resistance units if the available total output at the motive-power wheels is used as a basis for train-operating characteristics. A lesser value must be added for lighting energy. In order to obtain proper results, the average of the maximum requirements for mechanical or electromechanical air-conditioning equipment may be taken as 25 hp. per car, and the requirements for electric lights and battery charging may be taken as 5 hp. per car, or a total of 30 hp. per car, at speeds of 30 m.p.h. and higher. This power input to axle generators can be reduced to train-resistance values according to the following example for a 50-ton car:

$$\text{At 30 m.p.h. } \frac{\text{hp.} \times 375}{S \times W} = \frac{30 \times 375}{30 \times 50} = 7.5 \text{ lb. per ton}$$

$$\text{At 90 m.p.h. } \frac{\text{hp.} \times 375}{S \times W} = \frac{30 \times 375}{90 \times 50} = 2.5 \text{ lb. per ton}$$

At the slower speed, the power for air conditioning and lighting will exceed that required on level track for the remaining features of train operation.

The foregoing applies in part to steam air-conditioned cars. In this case, where steam motive power is used, the required amount of steam (250 lb. per car) will cause a decrease in the boiler capacity available for traction and consequently reduce the wheel output, as expressed in tractive force at a given speed, if the boiler and not the cylinders is limiting. Some additional axle-generator output is also required to operate certain air-conditioning auxiliaries, but not as much as that necessary for mechanical or electromechanical equipments.

For the streamlined articulated trains, with power

units, it is the practice to supply air conditioning and lighting through the medium of an auxiliary generator driven from the main engine unit, or from an auxiliary engine set. In these cases the required power does not represent a deduction from that considered as available for traction purposes, hence the train-resistance units are not affected.

Following are some examples of specific cases to show anticipated resistance units, lacking grade increments that depend entirely on profile conditions; but with assumed head wind, air-conditioning, lights, and curve-resistance units added. The streamline design and factors affecting wind resistance are assumed as having been worked out to the best advantage.

Example No. 1

Consider a streamlined 200-ton locomotive 80 ft. long hauling a ten-car train, the cars of which are streamlined, weigh 50 tons each, are 70 ft. long, and have an effective perimeter of 40 ft. The cars are equipped with electromechanical air-conditioning equipment and electric generators, the power requirements of which are 25 hp. and 5 hp. per car, respectively. Assume a head-wind velocity of 10 m.p.h., a train speed of 90 m.p.h., and an average track curvature of 30 min.

The resistance of the locomotive is

$$\begin{aligned} R &= 1.30 + \frac{29}{w} + 0.03 V + \frac{(0.023 \sqrt{L}) V^2}{W} \\ &= 1.30 + 1.16 + 2.70 + 4.95 \\ &= 10.11 \text{ lb. per ton} \end{aligned}$$

For the cars

$$\begin{aligned} R &= 1.30 + \frac{29}{w} + 0.03 V + \frac{\left[0.0694 \times \left(\frac{L_c}{100} \right)^{0.88} \right] V^2}{W} \\ &= 1.30 + 2.32 + 2.70 + 7.69 \\ &= 14.01 \text{ lb. per ton} \end{aligned}$$

For air conditioning and lights

$$R = \frac{30 \times 375}{90 \times 50} = 2.50 \text{ lb. per ton}$$

Therefore, the total resistance for the cars is $2.50 + 14.01 = 16.51$ lb. per ton. For the locomotive and cars

$$\begin{aligned} R &= \frac{(10.11 \times 200) + (16.51 \times 500) + (0.4 \times 700)}{700} \\ &= 15.09 \text{ lb. per ton} \end{aligned}$$

The horsepower output at wheels for balanced speed on level track is

$$\frac{15.09 \times 700 \times 90}{375} = 2534 \text{ hp.}$$

Example No. 2

Consider a locomotive-hauled train the locomotive of which is the same as that used in Example No. 1 and the cars of which are not streamlined (standard) but have the same proportions, weights, and air-conditioning and lighting equipment as the cars in Example No. 1. Assume also that the same head-wind velocity of 10 m.p.h., same speed of 90 m.p.h., and same average track curvature of 30 min. as used in Example No. 1. Then the resistance offered by the locomotive is 10.11 lb. per ton, as calculated in Example No. 1. However, for the cars

$$\begin{aligned} R &= 1.30 + \frac{29}{w} + 0.03 V + \frac{\left[0.124 \times \left(\frac{L_c}{100} \right)^{0.7} \right] V^2}{W} \\ &= 1.30 + 2.32 + 2.70 + 9.69 \\ &= 16.01 \text{ lb. per ton} \end{aligned}$$

For air conditioning and lights

$$R = \frac{30 \times 375}{90 \times 50} = 2.50 \text{ lb. per ton}$$

Therefore, the total resistance of the cars is $2.50 + 16.01 = 18.51$ lb. per ton. For the locomotives and cars

$$R = \frac{(10.11 \times 200) + (18.51 \times 500) + (0.4 \times 700)}{700} \\ = 16.51 \text{ lb. per ton}$$

The horsepower output at wheels for balanced speed on level track is

$$\frac{16.51 \times 700 \times 90}{375} = 2774 \text{ hp.}$$

Example No. 3

Consider a streamlined articulated eight-axle 198-ft. train weighing 120 tons. Assume the head-wind velocity to be 10 m.p.h., the train speed to be 90 m.p.h., and the average track curvature to be 30 min. The train resistance

$$R = 1.30 + \frac{29}{w} + 0.03 V + \frac{\left[0.07 \times \left(\frac{L}{100} \right)^{0.8} \right] V^2}{W} \\ = 1.30 + 1.94 + 2.70 + 10.07 \\ = 16.01 \text{ lb. per ton}$$

The total resistance including track curvature is

$$\frac{(16.01 \times 120) + (0.4 \times 120)}{120} = 16.41 \text{ lb. per ton}$$

The horsepower output at wheels for balanced speed on level track is

$$\frac{16.41 \times 120 \times 90}{375} = 473 \text{ hp.}$$

Conclusion

It has been the purpose of this article to set forth all of the factors affecting train resistance, which apply in general to modern railroad passenger-train operation. If analyzed in a critical manner for a particular set of conditions, undoubtedly minor adjustments will be in order since resistance units will be affected by details in the shapes of such details as the head end, tail end, roof, wheel fairings, and window embrasures. It is believed, however, that for ordinary use the formulas herein given, and the remarks applicable thereto, will be of service.

Railroad Construction Indices for 1936

(Continued from page 74)

these accounts is grading which, from a high of 250 in 1920, fell in 1933 to 98; in 1935 it had advanced to 101, but it receded again in 1936 to 99.

Accounts in which skilled labor is a large factor reflect improved wages. Notable among these is equipment which struck a high of 265 in 1920, a low of 153 in 1932-1933, and in 1936 was 181. Rails advanced slightly to 124 as against a high of 168 in 1920, and a pegged price, making an index of 144 in the period 1925-1931, inclusive. Ties which reached 201 in 1920 struck a low of 139 in 1933, were up to 147 in 1935 and 150 in 1936.

The bureau's indices are shown not only for the coun-

try as a whole, but for the eight regions in which the country is divided by the commission's Statistics for Railroads of the United States.

The indices shown for accounts which include items such as grading, tunnel excavation, bridges, ballast haul and tracklaying and surfacing were developed from analysis of major construction contracts covering a period of over thirty years and from joint studies made with the various sub-committees of the Presidents' Conference Committee. The indices shown for material accounts such as ties, rails, other track material, ballast and fences were based on studies of carriers' returns to Valuation Order 14, joint studies made with the various sub-committees of the Presidents' Conference Committee, well-known engineering and trade publications, contracts covering major construction projects over a period of 30 years, and other information furnished by individual carriers.

The indices, the explanatory statement says, represent territorial index factors and are of value in indicating trends. They are not necessarily applicable for use in the determination of reproduction costs upon individual railroads, telegraph or telephone companies, or other utilities.

The accounts for which the indices are shown are the several primary accounts designated in the Classification of Investment in Road and Equipment of Steam Roads. The accounts are as follows:

I—ROAD:

1. Engineering
2. Grading
3. Underground Power Tubes
4. Tunnels and Subways
5. Bridges, Trestles and Culverts
6. Elevated Structures
7. Ties
8. Rails
9. Other Track Material
10. Ballast
11. Track Laying and Surfacing
12. Right-of-Way Fences
13. Snow and Sand Fences and Snowsheds
14. Crossings and Signs
15. Station and Office Buildings
16. Roadway Buildings
17. Water Stations
18. Fuel Stations
19. Shops and Enginehouses
20. Grain Elevators
21. Storage Warehouses
22. Wharves and Docks
23. Coal and Ore Wharves
24. Gas Producing Plants
25. Telegraph and Telephone Lines
26. Signals and Interlockers
27. Power Dams, Canals and Pipe Lines
28. Power Plant Buildings
29. Power Substation Buildings
30. Power Transmission Systems
31. Power Distribution Systems
32. Power Line Poles and Fixtures
33. Underground Conduits
34. Miscellaneous Structures
35. Paving
36. Roadway Machines
37. Roadway Small Tools
38. Assessments for Public Improvements
39. Revenues and Operating Expenses During Construction
40. Cost of Road Purchased
41. Reconstruction of Road Purchased
42. Other Expenditures—Road
43. Shop Machinery
44. Power Plant Machinery
45. Power Substation Apparatus
46. Unapplied Construction Material and Supplies

II—EQUIPMENT:

51. Steam Locomotives
52. Other Locomotives
53. Freight-Train Cars
54. Passenger-Train Cars
55. Motor Equipment of Cars
56. Floating Equipment
57. Work Equipment
58. Miscellaneous Equipment

III—GENERAL EXPENDITURES:

71. Organization Expenses
72. General Officers and Clerks
73. Law
74. Stationery and Printing
75. Taxes
76. Interest During Construction
77. Other Expenditures—General

Communications and Books . . .

The Railway Age cannot publish letters from readers who do not supply their names and addresses. Names of correspondents are not published, or disclosed even upon inquiry, unless the correspondent consents. But they must be given us as an evidence of good faith.

Prefers Lewis and C. I. O. to "Aristocratic Brotherhoods"

TUCKAHOE, N. Y.

TO THE EDITOR:

Your article in the July 3 edition of *Railway Age* in which you note the similarity of Lewis's tactics and those of big business, was very true. During the recent labor struggles, industry is just beginning to feel what the railroads have suffered for years. American railroads pay out almost half their earnings to labor in spite of the fact that they are very highly mechanized and have heavy fixed charges.

The advocates of labor legislation for railroads use Lewis as the dangerous alternative, if their laws are not passed. However, Lewis would be a lot better than the aristocratic railway unions and unjust labor laws that rule the railroads. Why not organize the negro porters and redcaps under the C.I.O., so that they may demand promotion to brakemen. If they could replace the present trainmen, the railroads would be aided by their low wage scale.

I believe the only way to fight labor unions is with labor unions. Lewis may be much more compromising than the aristocratic railway brotherhoods.

Let's do something about it.

JOHN C. BLOM.

Working Agreements Need Revision

24 EAST 39TH STREET,
NEW YORK.

TO THE EDITOR:

In the pending wage negotiations, why shouldn't management hold out for revision of working agreements in return for increases in pay? For example: If the brotherhoods would permit the removal of superfluous men from passenger train crews, the resulting savings in the cost of running passenger trains would enable the railways not only to raise the wage scale of essential personnel, but to put on new services not now economically justified, thus increasing employment instead of curtailing it.

It can't, of course, be expected that labor leaders will take Adam Smith's word for it, but they might take Dan Willard's, if put in the form of a clear-cut and specific agreement. Sound economics will appeal only if guaranteed in advance to work. To win the co-operation of labor in promoting efficiency would be worth a considerable increase in the payroll, and a good deal in the way of assuring employment. Wage increases are inevitable anyhow, and labor leaders, as well as the rank and file, are concerned only with the employment of the present membership. There need be no promises to new men. With railway business on the upgrade, management would be justified in going to some lengths to give security to old employees transferred out of sinecures into real jobs.

Certainly such a program would appeal to the public, which is in a very friendly mood to the railways right now, and is turning thumbs down on extreme labor policies. Everyone knows that there are too many men on railway trains. The rear brakeman, lolling at ease in the best seat in the observation car, is a familiar figure; and who hasn't commented on the one-man bus and the six-man train, each with its thirty passengers? If it came to a showdown, what responsible and hard-headed railway labor leader would wish to risk public disapproval by opposing a plan obviously in the interest, not only of the railways and the public, but of labor itself?

The man in the street has got the idea that the railways have set a fine example in dealing with labor, and that they have leaned over backward in being fair. I believe that management could count on public support if it met demands for wage increases by saying, "Yes, provided we cut out all the nonsense in present working agreements." If, in addition, the public learned that no one was going to lose his job, but was to be guaranteed a better one, a strike simply wouldn't be tolerated. Public opinion would head it off before it started. The present demand for wage increases is management's opportunity to demand in return its money's worth from railway labor.

THORN DICKINSON

An Appeal to Employees By a Locomotive Engineer

BUFFALO, N. Y.

TO THE EDITOR:

Interested, as we all are, in one of the greatest industries of our country and one which has done more to develop the United States and bring prosperity to our millions of citizens, I am just wondering if the thinking people of the great army of railroad workers and the shipping public are giving due consideration to the menace that threatens the railway industry occasioned by the hostile, unwise and inconsistent legislation now pending before the various legislative bodies having a tendency to enormously increase expense without any increase in revenues.

Legislation of this character sponsoring a "more jobs" program, such as the six-hour day, full crew laws, train limit, etc., together with a 20 per cent increase in wages, demanded by leaders of certain labor unions, means the entire elimination of the still narrow margin between expense and earnings of the roads. Samuel Dunn of the *Railway Age* in a recent address before the Central Railway Club of Buffalo, N. Y., stated: "In fact their entire future depends upon the prevention of such elimination," otherwise receivership, government ownership, and the folding up of the great railway systems is inevitable.

Certain recent rulings of the National Railroad Adjustment Board, based entirely on technicalities, have been notoriously unfair, having penalized the carriers heavily beyond any point of rule or reason and while I believe labor, as a whole, has never had a just reward for its efforts, all questions and controversies should be settled and awarded on their merit only—otherwise, so-called victories are like the deadly boomerang that will return and inflict a painful if not fatal blow. Already we hear rumors that would be most harmful to our harmonious working conditions. Let us not try to kill the hen that lays the golden egg.

Proposed Laws Not Comparable to Safety Laws

True it is, the railway managements made many mistakes in the past by indulging in practices that have, in some measure, been responsible for regulatory legislation. Labor, organized and unorganized, has supported every reform and improved method, which, in turn, have been of great value to the carriers even though at first opposed by them. For instance, the electric headlight, the automatic coupler and safety appliance laws, etc.—all of which have cost the roads huge sums of money but in a final analysis these reforms have been in the interest of the carriers as well as the employees and the public at large. But the time has now arrived when a more consistent support and co-operation should be accorded the roads in the elimination and prevention of foolish and unwise legislative action. By some authorities this would be considered unethical, but it is as I view the picture.

When we stop to consider the various law-making bodies that regulate the railroads it is almost marvelous that they are able to function at all. Forty-eight state legislatures with a corresponding number of railroad or public service commissions, a total of ninety-six. Then the Federal government at Washington, while above and beyond all these law-making institutions is

the all-powerful Interstate Commerce Commission that absolutely rules the roads with an autocratic control. Fortunate indeed is it that the roads are operated by the biggest, brainiest, and most courageous executives in America, who have been able to keep the railways in operation even though handicapped by the numerous regulatory authorities. Many people seem to forget, or at least ignore, the rapidly increasing competition confronting the railway carriers in the form of trucks, buses, airways, and inland waterways, to say nothing of the subsidized coastal water routes, all of which are operating on natural or free routes which the railroads are heavily taxed to support, whereas the railways must buy, build and maintain their own routes and tracks. In addition the enormous cost of grade-crossing elimination, which is of national scope, falls heavily upon the railroads, they being required to bear one-half the cost, which again benefits the traveling public, trucks, and buses without any benefit to the roads.

My fellow workers, give this appeal serious consideration. Let us make the railroad business our business. Let us give more thought and co-operation in the protection and support of our employing companies, not only among our own ranks but also with the traveling and shipping public.

Since 1931 the railroads have been operating at a loss and have maintained their schedules only by borrowing heavily from the R.F.C. and are now only just emerging from the "red." We should at present be satisfied with our conditions and wages. We are asking the companies to do something for us when we finish our active careers and the Railroad Retirement Act is the result. The roads have come across magnificently. We should show our appreciation by good co-operation. If the roads prosper we will be taken care of; if they break down we are lost. At the peak of 1920 the railroads employed 2,200,000 men. Today we are a scant 1,000,000.

Wage Increase Inopportune Now

While it is true the splendid working conditions and wages of today have been accomplished by the constant efforts of organized labor through a period of thirty years as a result of collective bargaining, we must concede to the managements of the railroads a position of fairness and co-operation. During this long cycle of time the writer has been permitted to sit in the councils of road and labor and at every conference we have come away with something worth while in the way of wages and conditions, even though not all we asked for, but a cordial and harmonious spirit has prevailed. May this condition continue to exist and it will, unless labor is carried off its feet by unwise leadership, as is threatened in the great wave of popularity of the C.I.O. and national influences which are worthy of support but must be tempered with judgment and justice. In our own ranks, I believe the demand for a 20 per cent increase in wages at present is most inopportune, coming at a time when the roads are just emerging and spending huge sums for refinancing and equipment.

Fellow-workers, our interests and welfare is the prosperity of the carriers. Prosperity for the railroads means more jobs, better earnings, more stable employment.

It will be our splendid privilege to keep abreast of the times and support the industry on which our existence depends.

FRANK M. CRAVEN,
Locomotive Engineer,
Lehigh Valley.

New Book

United States Regulations for Steam and Other than Steam Locomotives. Published by Gibson, Pribble & Co., Richmond, Va. 218 pages, 6½ in. by 4 in. Price, \$1.25.

Four government booklets, completely indexed as one, are brought together in this book. They are the Laws, Rules and Instructions for Inspection and Testing of Steam Locomotives and Tenders; those for Other than Steam Locomotives; Interpretations, Rulings and Explanations on Questions Raised Relative Thereto, as prescribed by The Interstate Commerce Commission, Bureau of Locomotive Inspection, and Safety Appliance Standards for Locomotives as fixed by order of the Commission, dated March 13, 1911.

Odds and Ends . . .

Great-Grandfathers

The great-grandfather club recently formed on the Chesapeake & Ohio-Pere Marquette has a new member in N. E. Miner, pensioned chief tie inspector of the P. M. Mr. Miner is the proud great-grandfather of a two-year-old boy.

Brother Enginemen

Paul, Lee and Colie Chandler, enginemen for the Illinois Central out of Jackson, Tenn., claim the brother service record of the American railways. Lee has served 52 years, Colie over 50 years, and the "kid brother" Paul, 48 years.

Regular Attendance

If gold stars were given for regular attendance, as in the old Sunday School days, F. T. Beckett, assistant chief engineer, Chicago, Rock Island & Pacific, would have a large collection of them. He hasn't missed a day in his service of more than 40 years with the Rock Island.

Morning Coffee

This department delivers a vote of thanks to the Louisiana & Arkansas, which is the only railroad providing its sleeping car passengers with early morning coffee in their berths. A tray containing coffee, sugar and cream is passed in to the passenger as soon as he is awakened by the porter. This is a delightful continuation of an old Louisiana plantation custom.

Nuts!

A pet squirrel which escaped in a Pullman car gave the New Orleans yard force a hard day's work. All attempts to drive, coax, or bribe the squirrel from his hiding place in the space occupied by the air-conditioning apparatus having failed, a vigorous application of fumigation was tried. The fugitive was finally found, still alive, near the fresh air intake.

Railway Weather Man

Harold Duflocq, ticket clerk for the Baltimore & Ohio in New York, is frequently called upon to serve for months at a time as the city's official weather adviser. Taking up the study of weather as a hobby some years ago, Duflocq has developed his knowledge until he is now outstanding in the country in his field.

Cameron Honored

Because of his interest in adult education, notably in the development of the Illinois Central, C. C. Cameron, vice-president in charge of traffic, will become an honorary member of Alpha Chapter of Beta Gamma Sigma, honor society for men in the School of Commerce at the University of Illinois. Mr. Cameron's induction into the fraternity took place at a dinner attended by faculty members and students at Urbana, Ill.

This is the second honor awarded Mr. Cameron at the University of Illinois recently, the other having been his appointment to membership to one of the committees authorized by the University Board of Trustees and made up of prominent men of the state to advise with the college faculty in educational matters to the ultimate purpose of getting more education in business. The committee to which Mr. Cameron was appointed will work with the College of Commerce in the field of transportation.

The apprentice school of the Illinois Central system, which has attracted attention in industrial circles throughout the country, has enrolled an average of 700 employees, including the 50 apprentices with which the classes started, in its courses this winter.

NEWS

Tax Aid to Rivals Why Not to Rails?

C. N. R. economist points to huge waterway subsidy — Why not aid rails similarly

Public investment in water transport facilities which yields no return upon the investment is viewed with complacency by many persons, who at the same time criticize any non-remunerative expenditure of government funds upon railway facilities. This inconsistency was pointed out by S. W. Fairweather, director, bureau of economics, of the Canadian National, in a recent address at Kingston, Ont.

"The people of this country," he said, "have 770 millions of dollars invested in improvements to water transport, such as canals and harbors, most of which is non-revenue producing. No sensible man, however, would say that the decision to improve our waterways was unsound. By reason of these improved waterways, the development of natural resources of our country has been facilitated, adding to the national wealth. Just so it is with the Canadian National Railways, for railways have been a much more potent factor in the development of Canada than waterways could ever hope to be.

"Pioneering development is expensive. It is a safe generalization that no railway system can be built and operated for development purposes and in the earlier years pay interest on the cost of construction under a set of rates which are dictated by the necessity of encouraging development. A curious situation arises that while the nation gets rich as a result of the development, the railway shows deficits, unless subsidized. We, in Canada, have pursued both policies. We have paid huge subsidies in cash and land for development purposes, and quite wisely so. We have also absorbed deficits for development purposes, and quite wisely so. I can see no difference between the two, but it is a curious quirk, in the minds of some of our critics that subsidies to privately owned enterprises are examples of wise and statesmanlike policy, but a deficit incurred by a nationally owned enterprise, for the same purpose, is a veritable threat to our national existence."

It was easy, the speaker continued, for the general public to over-estimate the importance of the economies to be secured by the elimination of existing railway lines. We should, however, avoid uneconomic duplication of railway facilities in the future.

Eastman Re-appointed

President Roosevelt on July 9 sent to the Senate the nomination of Joseph B. Eastman for re-appointment to the Interstate Commerce Commission for the term expiring December 31, 1943. Mr. Eastman's term, as well as that of Commissioner Hugh M. Tate, expired at the close of last year, but both have continued to serve under a recent amendment to the Interstate Commerce Act which provides that members may serve until their successors have qualified for office. The President has not yet acted with respect to Commissioner Tate. Mr. Eastman's appointment is expected to receive speedy confirmation in the Senate as soon as the committee on interstate commerce gets around to reporting it.

"The Canadian National," he went on to say, "is frequently attacked because its operating ratio is relatively high and this is assumed to be evidence of inefficient operation. It is no such thing. With a relatively small volume of business per mile the operating ratio will be high and as the amount of business done per mile increases the operating ratio should drop very rapidly at first and thereafter at a slower rate. One of the most striking tests of the efficiency of the Canadian National has been the manner in which the operating ratio has reacted to increasing business per mile of line.

"Consider too the condition of the properties when they were acquired by the Dominion Government, how they were run down and how some of what are now our main lines were derisively referred to as 'turkey trails.' Having these things in mind the wonder is that the operating ratio has been kept as low as it has been. Remember the properties now comprised in the Canadian National had an operating deficit of \$35,000,000 in the year 1920. This was changed to such an extent that the properties had an operating surplus of \$56,000,000 for the year 1928—an improvement of \$91,000,000."

Warehousing at New York

Upon request of Judge Murry Hulbert of the United States Court for the Southern District of New York, the Interstate Commerce Commission has postponed from August 14 to October 13 the effective date of its order requiring railroads to discontinue certain warehousing practices at New York.

Board Hears Talk of Car Shortages

Present and impending situation discussed at meeting of Midwest group

Present and impending freight car shortages were the major subjects discussed at the forty-second regular meeting of the Midwest Advisory Board at Chicago on July 8. Shippers generally complained of a shortage of 50 ft. box, gondola and flat cars and anticipated a more serious situation with increased carloadings.

Recommendations for avoiding a serious shortage were voiced by shippers and railroad representatives. One shipper suggested that flooring on flat cars which makes the blocking of machinery hazardous, be renewed so that fewer cars will be rejected. Another contended that eastern lines should be forced to release 50 ft. cars belonging to western lines or be ordered to build more for their own use.

W. D. Beck, district manager of the Car Service division at Chicago, advocated strict observance of ownership rules, the avoidance of pyramiding of car orders, the prompt loading and unloading of cars, the routing of cars to places where needed, the movement of empties on Sundays and holidays and that ownership of cars be considered when making shipments. L. M. Betts, manager of the closed car section of the Car Service division, suggested that a special grain committee be formed to assist in the movement of grain in the midwest.

Lumber shippers reported a shortage of 50 ft. and 40 ft. high box cars, particularly in Wisconsin. Coal shippers are now experiencing a mild shortage of coal cars in southern Illinois and anticipate an increase of 5 to 10 per cent in shipments during the third quarter of the year with a flurry of buying in the latter part of the quarter.

Considerable difficulty has already been experienced in the movement of winter wheat from Kansas, Texas and Oklahoma. In these states the wheat crop is 25 per cent in excess of that harvested last year and the oat crop is 30 per cent larger. Much wheat is on the ground awaiting shipment, and a large movement of grain from western Indiana, Illinois, Iowa and the Ohio Valley is about to begin. This situation is due to the inability of country elevators to handle the grain rather than to the failure of the railroads to supply cars, for with the extensive use of the combine the wheat is being harvested too fast for the elevators to handle.

F. E. Lyford Ratified As O. & W. Trustee

I. C. C. okays Baldwin officer for post, but vetoes Dailey as inexperienced

The Interstate Commerce Commission, Division 4, has ratified the appointment of Frederick E. Lyford as trustee of the New York, Ontario & Western, denying at the same time the similar application of Vincent Dailey, who had been nominated by the court for the position of co-trustee with Mr. Lyford. The majority report by Commissioners Meyer and Porter took the position that because the O. & W.'s "property and operations are not very extensive" one trustee should be sufficient to properly serve the interests of all parties." Commissioner Mahaffie, dissenting in part, would have ratified both, because "the trustee of this property, in addition



Frederick E. Lyford

to operating the railroad, will be greatly concerned with the coal business."

The report sketched briefly the experience of both nominees, pointing out how Mr. Lyford had been associated with the Lehigh Valley "in mechanical and special engineering capacities" for ten years prior to 1934, when he became an examiner with the Railroad division of the Reconstruction Finance Corporation; since September, 1936, he has been assistant to the vice-president and director of sales of the Baldwin Locomotive Works. Mr. Dailey is associated with the chairman of the board of the Bulova Watch Company in a consulting capacity; he has "been engaged in business of a commercial nature for 18 years," and was for two years associated with the New York State Democratic Committee, and for three years was New York state manager for the Home Owners Loan Corporation. Mr. Dailey planned to continue his present connection, but Mr. Lyford contemplates severing his association with Baldwin.

Edward G. Buckland, president of the O. & W., was unable to accept appointment as trustee because of his duties as chairman of the board of the New York, New Haven & Hartford and president of the Railroad Credit Corporation; he stated

that he would require a co-trustee, and expressed the opinion "that the debtor ought not to be required to undergo this additional expense."

In selecting Mr. Lyford as the sole trustee, the commission cited his experience, which "includes 13 years with railroads or dealings with railroad problems." Also, it called attention to the approval of his appointment by a "group of institutions holding about 40 per cent of the debtor's bonds"; and to the fact that "he would be able to devote all his time to his duties as trustee without any outside interests."

Railway Employment in June

Class I railways, excluding switching and terminal companies, had in June 1,171,302 employees, an increase of 1.51 per cent above May and of 8.7 per cent over June, 1936, according to the Interstate Commerce Commission's compilation based on preliminary reports. The index number, based on the 1923-1925 average as 100, stood at 65.6 as compared with 64.6 in May and 60.3 in June of last year.

Southwest Claim Agents Elect Officers

Officers elected for the ensuing year at the annual meeting of the Southwestern Railway Claim Agents' Association, held at Shreveport, La., on July 8-10, are as follows: President, F. W. Middleton, claim agent of the Louisiana & Arkansas; first vice-president, W. E. Davidson; second vice-president, Henry W. Rutland; and secretary-treasurer, F. D. Wilkins, general claim agent of the Texas Electric.

Rock Island Hearing

The Interstate Commerce Commission on July 8 adjourned further hearings in the Chicago, Rock Island & Pacific reorganization case until October 19. During the interim, the carrier's auditor will apply a new formula for the segregation of revenues and expenses by mortgage lines for the entire year 1936. Also, a study now being made of abandonment possibilities will have been completed.

Hearings were also held last week in Washington on the application of the Louisiana & Arkansas for authority to acquire the Rock Island, Arkansas & Louisiana, which now is a part of the Rock Island system.

New Haven Boat Line Strike

In a jurisdictional fight between rival unions a strike has been in effect for several days on the lines of the New England Steamship Company, an affiliate of the New York, New Haven & Hartford. The management has stated its willingness to negotiate with a union really representative of its employees and the Massachusetts department of labor polled the employees for their preference. One of the rival unions, however, denies the authority of the state labor department to take such a poll, claiming that it should be conducted by the National Labor Relations Board. The strike leaves residents of the Island of Nantucket without any regular means of transportation to and from the mainland.

Van's Lines Set-up Made Simpler

Alleghany Corp. obliterated in consolidation plan for holding companies

The boards of directors of Alleghany Corporation and the Chesapeake Corporation have unanimously approved a plan for the consolidation of the two companies, marking the disappearance of the name of Alleghany Corporation from the long list of top holding companies which have figured in the history of the Van Sweringen System. Previously there were the Vaness Company, General Securities Company, Van Sweringen Corporation, Cleveland Terminals Building Company, and more recently the Midamerica Corporation, in each of which control at one time rested.

The Chesapeake Corporation holds approximately 35.5 per cent of the common stock of the Chesapeake & Ohio and Alleghany Corporation, in turn, holds approximately 71 per cent of the common stock of the Chesapeake Corporation. The consolidation has been effected in order to eliminate one of these holding companies, and to simplify the capital structure through which stock is held. The name of the new holding company will be "Chesapeake Corporation."

The Chesapeake Corporation was formed in 1927 by the Van Sweringen interests to acquire the Chesapeake & Ohio stock then held by the New York, Chicago & St. Louis, and by the General Securities Corporation, a holding company controlled by the Vaness Company, and O. P. and M. J. Van Sweringen. The Alleghany Corporation was formed in 1929 by the Van Sweringen interests to acquire holdings in various major railroads largely under their control.

The present capitalization of the Chesapeake Corporation is a simple one consisting of 1,800,000 shares of common stock. The Alleghany Corporation capitalization is more complicated, consisting of:

Collateral Trust Convertible 5% Bonds, due 1944 and 1949	\$53,404,000
Collateral Trust Convertible 5% Bonds, due 1950	\$24,387,000
\$2.50 Cumulative Prior Preferred Convertible Stock, without par value, entitled to \$50 per share and accrued dividends in liquidation	119,833 shares
Cumulative 5½% Preferred Stock, Series A, of the par value of \$100 per share ..	667,539 shares
Common Stock, without par value	4,440,647 shares

Under the proposed plan of consolidation the holder of present Chesapeake Corporation common stock is given the alternative of accepting 1½ shares of the common stock of the Chesapeake and Ohio or 1 share of 5 per cent cumulative prior preferred stock of the new consolidated company. The collateral trust bonds of Alleghany Corporation are assumed by the new company. Each \$1,000 collateral trust bond due 1950 is offered \$200 in cash and \$800 in 5 per cent cumulative prior pre-

ferred convertible stock of the new company. The present \$2.50 prior preferred convertible stock of Alleghany Corporation is offered \$7.50 in cash and $\frac{1}{2}$ share of new 5 per cent cumulative prior preferred convertible stock of the new company. The series "A" preferred stock of Alleghany Corporation is offered 1 share of new \$5 convertible preferred stock and warrants to purchase at \$5 each two shares of new common stock. Each share of common stock of Alleghany Corporation is offered one share of common stock in the new company.

Upon consummation of the consolidation, and after giving effect to the exchange of all securities as outlined above including the issuance of new 5 per cent cumulative convertible prior preferred stock to all holders of the common stock of the Chesapeake Corporation, other than Alleghany Corporation, the outstanding bonds and stocks of the consolidated company will be as follows:

Collateral Trust Convertible	
5% bonds, due 1944 and	
1949	\$53,404,000
5 Per Cent Cumulative Convertible Prior Preferred	
Stock, par value \$100 per	
share	\$77,675,750
\$5 Convertible Preferred Stock,	
without par value	667,539 shares
Common Stock, without par	
value	4,440,647 shares

In the event that all minority common stockholders of the Chesapeake Corporation exercise their privilege of taking $\frac{1}{2}$ shares of the common stock of Chesapeake & Ohio instead of prior preferred stock of the new company then the outstanding amount of prior preferred stock shown above will be reduced from \$77,675,750 to \$25,501,250.

R. F. C. Loans to Railroads

The Reconstruction Finance Corporation's monthly statement as of June 30 shows disbursements to railroads, including receivers, of \$532,126,239.11 and repayments totaling \$177,806,386.17.

New W. & L. E. Car Dumper at Huron, Ohio

The Wheeling & Lake Erie on July 14 placed in operation a new all-electric car dumper for transferring coal from cars to boats at Huron Ohio. These facilities, which involved an investment of more than \$1,000,000, will greatly enlarge this road's capacity for the handling of coal at this point. Approximately 150 coal operators participated in a formal inspection of the facilities incident to the inauguration of operation.

Practitioners Want Independent I.C.C.

The Association of Practitioners before the Interstate Commerce Commission has gone on record in opposition to any legislation under which the commission would not be left free to determine both its policies within the principles laid down by the legislation defining its jurisdiction, and its personnel and needs for carrying on its work. This stand was set forth in a letter transmitted by the Association's special committee on proposed reorganization of government departments to all

members of Senate and House committees on interstate commerce and select committees on government organization.

The letter, which is signed by Edward S. Brashears as chairman of the special committee, states that the committee is making a careful study of S. 2700, the departmental reorganization bill recently introduced by the late Senator Robinson of Arkansas. It will make a similar study of any similar proposals, and seeks an opportunity to be heard on such bills.

Suspended from Practice Before I. C. C.

Edward F. Cody, of Sacramento, Calif., has been suspended from practicing before the Interstate Commerce Commission, pending the outcome of an investigation which the commission has ordered of alleged actions by him in handling for a group of clients a complaint involving carload rates on automobiles from points in the Middle West to destinations in Washington and Oregon. The case has been set for hearing at Portland, Ore., on August 11.

Drought Relief Rates

The Interstate Commerce Commission has authorized the Northern Pacific to establish reduced rates for the transportation of live stock from drought-stricken areas in Montana to available feeding lots on its lines and those of the Minnesota & International and the Big Fork & International Falls in Montana, North Dakota and Minnesota. A similar order permits the Great Northern to establish like rates from areas in addition to those for which authority was previously obtained.

Oppose Pettengill Bill

A resolution opposing the passage of the Pettengill bill now pending in the Senate was passed at a meeting of public utility and corporation commissioners at Denver, Colo., on July 9, the resolution contending that the long and short haul provisions of the Interstate Commerce act should remain under the jurisdiction of the commission. Spokesmen were present from Arizona, Arkansas, Missouri, Idaho, Minnesota, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, New Mexico, Colorado, Wyoming, Montana, Utah and Nevada. Two states, Colorado and Wyoming, asked permission to file their votes later.

Wage Discussions Resumed

Wage discussions were resumed in Washington, D. C., this week by the railroad management committee and representatives of the 14 non-operating unions which are demanding an increase of 20 cents per hour and certain guarantees as to full time employment. The meetings which began on Wednesday were arranged after the unions had launched a strike vote and the National Mediation Board, offering its services in the controversy, had procured an agreement for the resumption of negotiations.

It is understood that the management group has offered an increase of two cents per hour and put out "feelers" in connection with four cents per hour. The Mediation Board was expected to enter the negotiations on Friday if no progress toward an agreement were made by that time.

tion with four cents per hour. The Mediation Board was expected to enter the negotiations on Friday if no progress toward an agreement were made by that time.

Court Grants Damages to Passenger Forced to Stand

Citing section 26 of the New York State Public Service Commission's Law requiring common carriers to furnish "such service and facilities as shall be sufficient and adequate and in all respects just and reasonable," the appellate term of the New York supreme court recently granted damages of \$47 to a passenger making suit against a New York carrier for fatigue sustained in standing for the duration of 150-mile coach journey. The plaintiff testified that no coach seats were available on the train, although, when at the start of the trip he questioned the conductor as to adequate accommodations, the latter replied, "We will straighten this out and there will be seats for everybody." He further stated that upon refusal to surrender his ticket, the conductor threatened to put him off the train. In claiming damages, the plaintiff declared that the ride of two hours and 45 minutes utterly fatigued him.

Equipment for China

The federal government's Export-Import Bank may aid in financing the sale to China of additional locomotives as well as other types of railway rolling stock and track materials, according to R. F. C. Chairman Jesse H. Jones, who is also chairman of the bank's advisory committee. Mr. Jones discussed this situation at a press conference on July 12, when he was asked if there had been any developments since the recent announcement that the Export-Import Bank had agreed to participate in financing the sale to China of 20 locomotives which have been ordered from the Baldwin Locomotive Works and the American Locomotive Sales Corporation.

Mr. Jones stated that China would like to buy rolling stock and track materials, but the bank has not yet received a list of what is desired. It was his view that some further loan might be involved whereby the Export-Import Bank might assist. China, he added, would like to pay in installments over a period of years; and any financing on that basis would perhaps involve participation by some bank in China as well as by Export-Import and the exporter of the equipment or materials bought. The details will have to be worked out in each individual case, and, while unable to give the total amount which might be involved, Mr. Jones expressed the view that China's requirements "can't be excessive."

Proposed Rules for Transport of Explosives by Motor Vehicle

The Interstate Commerce Commission has transmitted "to shippers and motor carriers" a copy of its proposed regulations governing the transportation of explosives and other dangerous articles by motor vehicle. They constitute Part V of the proposed motor carrier safety regulations and cover such matters as marking, shipping papers, loading, driving, stopping, design

and construction of equipment, accidents, and inspection and maintenance.

The letter of transmittal signed by Secretary W. P. Bartel states that "the proposed regulations constitute a first draft which is now being issued for criticism and comment. It is contemplated that a similar procedure will be followed in this case as was followed previous to the promulgation of Parts I to IV of the Motor Carrier Safety Regulations; that is, to invite comment and suggestion previous to a hearing on the subject. Suggestions are invited of relevant subject matter not included in the proposed regulations." Comments and criticisms should be submitted not later than August 15.

Money for Rivers and Harbors

The Senate debate on the judiciary reorganization bill this week delayed final Congressional action on the bill (H.R. 7493) carrying for the fiscal year ended June 30, 1938, appropriations for the non-military activities of the war department, including \$128,000,000 for previously-authorized rivers and harbors work. The Senate has yet to act on the conference report which was agreed to by the House on July 9.

One section of the bill provides for the repeal of \$3,000,000 of the appropriation for the purchase by the government of stock in the Inland Waterways Corporation. Major General T. Q. Ashburn in the latest annual report of the federal barge recommended this action—"unless it be the intention to further expand our operations." He pointed out that the \$3,000,000 remained earmarked in the U. S. Treasury for the purchase of additional Inland Waterways Corporation stock, but expressed the view that under its present set-up the Corporation "will never need it."

British Transport Leader Dies

Sir Eric Geddes, G.C.B., G.B.E., first Minister of Transport of Great Britain, passed away on June 23 at the age of 61 at his residence in Hassocks, England, as reported by the Railway Gazette (London). Born in India in 1875, and educated at Edinburgh, Scotland, he devoted several years of early life in the United States, working at various occupations, including service as brakeman on the Baltimore & Ohio. Returning to India, he served in various railway posts, finally becoming traffic superintendent of the Rohilkund & Kumaon. Again in Great Britain, Sir Eric entered the claims department of the North Eastern and by rapid promotions rose to become general manager in 1911.

It was during the war that he gained fame as organizer of the transport system at the front, subsequently assuming leadership of all transport activities, as Inspector General of Transportation. Interrupting his rail service to become First Lord of the Admiralty, Sir Eric, at the conclusion of the war, re-entered the field to assume the portfolio of the newly created Ministry of Transport. After distinguished service in the reconstruction of the British rail systems, he entered industry for a time, only to return to the transport field as chairman of Imperial Air-

ways, in which position he performed notable work in the development of civil aviation.

London-Portsmouth Electrification

On July 4 the Southern (Great Britain) commenced operation by electric power of its main line between Hampton Court junction, near London, to Portsmouth harbor, with a branch to Alton, 95 route miles, or 242 track miles. This extension brings the electrified portion of the Southern's lines to a total of 540 route and 1,408 track miles and makes possible complete electrified service on the 74-mile run between London and Plymouth.

Passenger service on the routes outlined is maintained entirely by multiple unit cars, propelled by 660 volts d.c., delivered from a third-rail system. Rolling stock for suburban runs consists of two-car and three-car units, each motor car having two 276 hp. motors, while that for through service is made up of 29 four-car coach units and 19 four-car units containing one dining car, each motor car carrying two 225 hp. motors. Line electrification involved the construction of 26 mercury-arc rectifier substations and the cost of the entire project, including construction of the 312 new multiple-unit cars required, totaled £3,070,289 (\$15,228,633).

Roads to Refund Pension Taxes

The carriers will, in the near future, refund to their employees collections representing the salary deductions made under the taxing act of 1935, as provided by the old Railroad Retirement Act, and kept intact in non-interest bearing accounts by the roads since the act was held unconstitutional by the federal court for the District of Columbia. The refunds will comprise the 3½ per cent wage deductions made between March 1, 1936, and January 1, 1937, plus the ¾ per cent excess between January 1 and June 29 of the abandoned taxing rate over the 2¾ per cent rate of the new act, which is retroactive to January 1.

The refund is specifically provided for in the new tax act passed by Congress and signed by President Roosevelt on July 1, and has been given legal sanction by dismissal of the suit attacking the constitutionality of the original act by consent of the government and by agreement of the rail and labor representatives which were parties to the suit. The new tax act likewise relieves the carriers themselves from payment of their share of contributions levied by the old act, an amount equal to employee deductions for the same period. In the case of a few roads which actually paid their share of the taxes to the United States treasury, refund in full will be made by the government, while those carriers which contested the act and withheld payment of taxes are to be clear of such obligations incurred under the abandoned act.

Express Agency Rail L.C.L. Service Questioned

Setting forth the argument that the pick-up and delivery of L.C.L. freight service which it performs for many rail carriers throughout the country should be classed as that of a private or contract carrier,

the Railway Express Agency, Inc., is seeking to restrain an order of the Pennsylvania Public Service Commission (disbanded in June 1 and superseded by the Pennsylvania Public Utility Commission) forcing the agency to discontinue such service until it obtains certificates as a common carrier in all communities wherein it performs the freight service for the railroads. Independent trucking interests represented by Gilbert Nurick, counsel for the Certified Motor Carriers' Association, and Harold Shertz, appearing for the Pennsylvania Motor Truckers' Association, claim that the agency's freight pick-up and delivery services are common carrier operations and should be subject to the certification requirement.

The brief presented by Albert Hartung for the express agency, on the other hand, demonstrates that the L.C.L. service is actually a contract operation, constituting the performer of the service a private carrier and points to the recent decision of the Interstate Commerce Commission granting the status of contract carrier to Scott Brothers, a trucking firm performing pick-up and delivery service for the Pennsylvania and the Long Island. The proceedings have been instituted by the commission under provisions of an act of June 1 which requires that all incomplete hearings of the old commission be brought up for continuance.

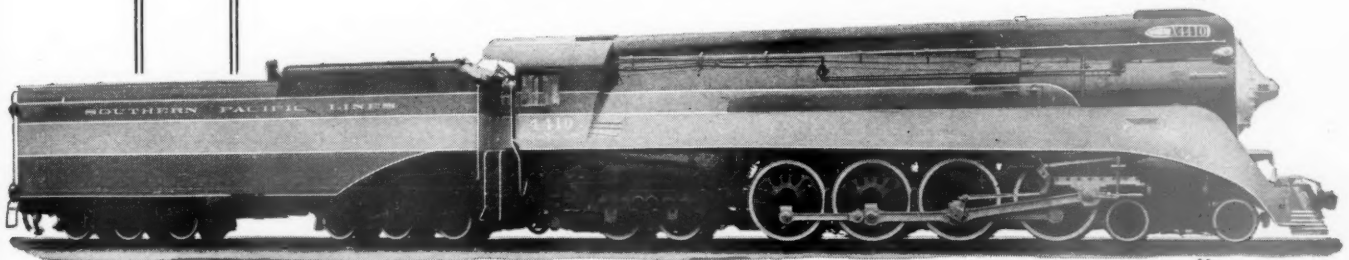
Medal of Honor Award

Upon recommendation of the committee on award of medals of honor, approved by the Interstate Commerce Commission, President Roosevelt has awarded a medal of honor to Arnold F. Haack, of Superior, Wis., a switchman on the Chicago, St. Paul, Minneapolis & Omaha. The medal was awarded under the act of 1905, which provides for bronze medals of honor to be awarded for outstanding feats of bravery in connection with the saving of life upon railroads.

The act which resulted in this award was performed on January 7, 1937, at the Tower avenue crossing of the C., St. P., M. & O. in Superior, where Switchman Haack rescued from beneath the truck of a freight car a 53-year-old woman who had been struck down as she ran onto the crossing after a dog. The citation says that "Switchman Haack, who had started toward her when he saw her turn back onto the track, leaped to her assistance, seizing her by the coat with his right hand; placing his left hand against the drawbar of the car he walked backward in the direction the train was moving, dragging the woman who was partly under the leading truck. There was considerable ice on the crossing and as Switchman Haack attempted to pull the woman free he slipped and fell to the track beside her. Grasping her by the shoulders, and throwing his feet and legs outside the south rail, he rolled the woman's body over his, clear of the track; however, her right foot was run over by the leading wheel of the car and so badly crushed that it was necessary later to amputate it. Switchman Haack was uninjured."

Forty-four medals of this character, in-

MODERN POWER



... is
BALANCED
power

By combining modern power producing elements into a harmonious design, the modern locomotive provides high tractive effort for starting and a relatively high tractive effort at the high speeds required by modern train operation. » » » The result is a power unit that delivers greater ton-mile output at lower cost and yields substantially greater net earnings.

LIMA LOCOMOTIVE WORKS, INCORPORATED
LIMA, OHIO



cluding Switchman Haack's, have been awarded since the enactment of the Medals of Honor Act in 1905.

N. & W. Issues Vacation Guide

The Norfolk & Western has published for free distribution a 9¼ in. by 12 in. booklet of 42 pages, in natural colors, depicting Virginia resorts, recreational facilities, historic shrines and natural beauties and illustrated with 124 photographs, 15 drawings, and five paintings in color. The front covers of the publication, a richly colored painting of a gateway of a formal Colonial garden, is so arranged that when the reader turns back the covers, he thereby opens "the gates to the land of romance." The several divisions of the booklet describe in pictures the ocean resorts of the Virginia seashore, the Blue Ridge and Allegheny mountains and the state's natural wonders, the Shenandoah valley and the Shenandoah national park, and historic towns. The last chapter is devoted to "Luxurious Transportation," illustrated with a number of photographs of modern passenger equipment.

Railway Tie Association Meets

At a meeting of the corporate members of the Railway Tie Association at Louisville, Ky., on June 29, R. H. White, Jr., president of the Southern Wood Preserving Company, Atlanta, Ga., was elected president; Meyer Levy, vice-president of T. J. Moss Tie Company, St. Louis, Mo., first vice-president, and Walter H. Firmin, Wyoming Tie & Timber Company, Metropolis, Ill., second vice-president. T. J. Turley, Jr., vice-president of Bond Brothers Company, Louisville, Ky.; R. M. Killey, Wood Preserving Corporation, Charleston, S. C.; H. Tom Merritt, sales manager of Bond Brothers Company, Louisville, Ky.; R. M. Hamilton, vice-president of T. J. Moss Tie Company, St. Louis, Mo., and Leonard Perez, National Lumber & Creosoting Company, St. Louis, Mo., were elected members of the Executive Committee. The Executive Committee re-elected Roy M. Edmonds, St. Louis, as secretary-treasurer.

The association went on record in opposition to the Black-Connery Bill on the ground that it would increase the labor cost of tie production at least 25 per cent. The association also voted to formulate specifications for crossties which should be based upon the 1934 A.R.E.A. specifications and instructed its committee to take up with the Tie committee of the A.R.E.A. those revisions in the existing specifications which they believed advisable. At the conclusion of the business session, J. B. Hill, president of the Louisville & Nashville, and W. S. Campbell, vice-president and general manager of the Kentucky & Indiana Terminal, addressed those present.

Freight Car Loading

Revenue freight car loading for the week ended July 3 totaled 806,168 cars—a high for 1937 to date, and an increase of 156,465 cars or 24.1 per cent and 335,042 cars or 71.1 per cent respectively over corresponding 1936 and 1935 weeks. Both of these latter, however, included the July 4 holiday which this year came in the fol-

lowing week. The increase over this year's previous week, ended June 26, was 32,435 cars or 4.2 per cent. All commodity classifications except live stock showed increases as compared with the previous week, while all were above last year. The summary, as compiled by the Car Service Division, Association of American Railroads, follows:

Revenue Freight Car Loading			
For Week Ended Saturday, July 3			
Districts	1937	1936	1935
Eastern	162,686	137,427	104,515
Allegheny	161,975	130,177	87,286
Pocahontas	50,881	44,524	24,022
Southern	100,965	90,121	67,538
Northwestern ..	137,761	101,007	73,942
Central Western.	129,264	98,340	72,529
Southwestern ...	62,636	48,107	41,294
Total Western Districts	329,661	247,454	187,765
Total All Roads.	806,168	649,703	471,126
Commodities			
Grain and Grain Products	51,878	41,956	23,878
Live Stock	11,442	11,396	8,615
Coal	117,453	105,469	50,161
Coke	10,503	7,994	4,538
Forest Products.	41,723	30,910	21,952
Ore	78,790	45,337	30,687
Merchandise			
L.C.L.	169,147	142,052	133,575
Miscellaneous ..	325,232	264,589	197,720
July 3	806,168	649,703	471,126
June 26	773,733	713,588	616,853
June 19	756,289	690,667	567,049
June 12	754,360	686,643	652,111
June 5	692,140	695,844	629,712
Cumulative Total			
27 Weeks	19,734,274	17,233,497	15,631,855

In Canada.—Car loadings for the week ended July 3 totaled 46,131 as against 49,368 for the previous week and 46,909 for the twenty-sixth week last year, according to the statement of the Dominion Bureau of Statistics.

	Total Cars Loaded	Total Cars Rec'd from Connections
Total for Canada:		
July 3, 1937	46,131	26,312
June 26, 1937	49,368	26,280
June 19, 1937	49,044	26,543
June 27, 1936	46,909	22,601
Cumulative Totals for Canada:		
July 3, 1937	1,234,707	731,277
June 27, 1936	1,125,826	611,374
June 29, 1935	1,113,985	580,407

Colorado & Southern Controversy

The Colorado Public Utilities Commission has set July 21 as the date for hearing on the action instituted by the county commissioners of Park and Summit counties in Colorado and the Fairplay Gold Mines, Inc., seeking to halt the proposed abandonment of the South Park narrow gage line of the Colorado & Southern between Waterton, Colo., and Climax. The railroad, in its answer to the action, charges conspiracy on the part of Victor A. Miller, a Denver attorney, and certain associates to obtain possession of the line without cost. The county commissioners, in their petition, sought to prevent abandonment on the ground that no permission for the abandonment has been granted by the Public Utilities Commission. In its answer, the railroad says that it has permission from the Interstate Commerce Commission and charges that three suits now pending in court are part of the conspiracy. One suit, filed in Denver by Miller, seeks to compel specific performance of an alleged contract by which

the railroad agreed to turn over the line to Miller. This the railroad denies. The other two suits are pending in Park County. One, by the state of Colorado, is an injunction suit seeking to stop the railroad from tearing up its tracks, and the other, filed by the South Park Railway Company, is a condemnation suit. The railroad also contends that county commissioners have no right to spend county funds in an action of this nature and ask that the commissioners individually be compelled to reimburse their county treasuries.

Alton Adds Streamlined Train to Chicago-St. Louis Service

In order to better its local service and provide relief for through trains which are now carrying additional equipment, the Alton will, on July 26, re-arrange the schedules of several trains between Chicago and St. Louis and add a light-weight streamlined train. This train, the equipment of which was formerly operated in the Royal Blue between Washington and New York, will make a round trip each day, leaving Chicago at 8 a.m., arriving in St. Louis at 1:20 p.m., leaving St. Louis at 4:30 p.m. and arriving in Chicago at 9:25 p.m. The schedule of this train, 5 hr. 20 min. southbound and 4 hr. 55 min. northbound, provides for seven scheduled and one flag stop southbound and two scheduled and one flag and one conditional stops northbound. The equipment will consist of nine air-conditioned cars, including a combination baggage and smoking car, three individual reclining seat chair cars, a buffet lounge car, a dining car with table and counter service, two drawing-room parlor cars and an observation lounge parlor car. Stewardess-nurse service will be provided.

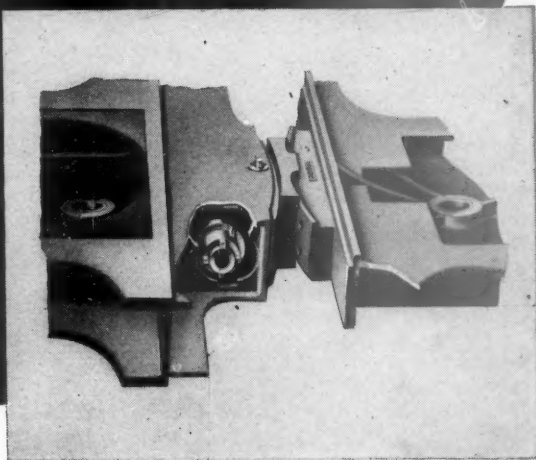
By setting the departure at 4:30 p.m. from St. Louis, the Alton is able to change the departure time of other trains to provide more frequent service. The Alton Limited, which now leaves St. Louis at 4:00 p.m., will depart at 12:05 p.m. and will arrive in Chicago at 5:35 p.m. instead of 9:45 p.m. The Prairie State Express, which now leaves St. Louis at 12:05 p.m., will leave at 2:45 p.m. and will arrive in Chicago at 9:05 p.m. instead of 6:15 p.m. Train No. 14 will leave Bloomington at 7:30 a.m. instead of 6:30 a.m. and will arrive in Chicago at 11:15 a.m. instead of 10:15 a.m.

Contracts and Charges of Contract Carriers

"In order that there be no misunderstanding" of its recent orders in that connection the Interstate Commerce Commission has issued a notice on the filing of contracts and schedules of minimum charges of contract carriers by motor vehicles.

The notice points out that Ex Parte No. MC 12 states in effect that after July 1, 1937, contract carriers may not transport property unless they have bilateral contracts complying with that order; Ex Parte No. MC 9 requires that a true copy of bilateral contracts (as required in Ex Parte No. MC 12) in force on July 15, 1937, must be submitted to the commis-

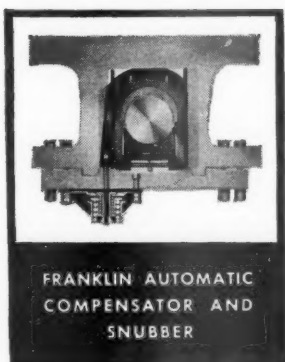
*"Engineered for
Easy riding"*



The Type E-2 Radial Buffer makes for safer and easier locomotive riding.

Its spherical and cylindrical faces permit movement in any direction, while its predetermined frictional resistance dampens all oscillation between engine and tender and avoids all lost motion and subsequent destructive shocks to drawbar and pins.

Its twin, the Franklin Automatic Compensator and Snubber, takes the job of maintaining proper driving box adjustment and further improves smoothness of operation, extends locomotive mileage and reduces maintenance costs.



When maintenance is required, a replacement part assumes importance equal to that of the device itself and should be purchased with equal care. Use only genuine Franklin repair parts in Franklin equipment.



FRANKLIN RAILWAY SUPPLY CO., INC.

NEW YORK

CHICAGO

MONTREAL

sion on or before that date, and if contract carriers enter into bilateral contracts on or after July 15, such contracts must be submitted within 20 days after their effective date; Ex Parte No. MC 9 requires that in addition to submitting to the commission a true copy of such contracts contract carriers shall file schedules of minimum rates and charges in the manner and form required in Supplement No. 2 to Tariff Circular MF No. 1.

While the commission requires contract carriers to submit one true copy of each and every contract in accordance with (1) and (2) above, these contracts, the notice continues, will not be open for public inspection and are required for the commission's information only and, therefore, such true copies submitted are not subject to the requirements as to title page, size, form or carrier's MF-I.C.C. series or any other rules contained in the commission's tariff circular. "The submission of a true copy of a bilateral contract," it adds, "does not relieve contract carriers from having their schedules of minimum rates on file with this commission, and kept open for public inspection at their principal places of business."

Would Restrict "Co-ordination" Plan of K. C. S. Affiliate

The plan of the Kansas City Southern Transport Company to furnish complete service by motor vehicle over the entire line of its parent railroad (the Kansas City Southern) from Kansas City, Mo., to Port Arthur, Tex., will be greatly restricted if the Interstate Commerce Commission adopts a proposed report in which Examiner P. S. Peyser has recommended that only two phases of the proposed extension of operations be approved. The examiner would approve the granting of certificates for common carrier operations over specified routes between Beaumont, Tex., and DeRidder, La., 78 mi., and be-

tween Heavener, Okla., and Forester, Ark., 56 mi.; but would deny in other respects the application which seeks certificates for several other routes, described generally as "between points in the states of Missouri, Kansas, Oklahoma, Arkansas, Louisiana, and Texas."

It was the hope of the applicant to develop highway routes paralleling the lines of the K. C. S. with a view to the co-ordination of its services with those of the railway "for the purpose of expediting the service and operating more efficiently and economically." It was contemplated in this connection that there would be in some instances "the complete substitution of motor vehicle service for rail merchandise service." The examiner does not think that the latter is the "co-ordination" visualized by congress when it passed the motor carrier act, it being his view that "clearly, the co-ordination of transportation that is sought by the congress is that between carriers using different kinds of transportation." "Under the act," he adds, "a rail carrier has no inherent right to transfer its traffic from its rails to the highways; it is required to show public convenience and necessity for this operation, in the manner required of any other applicant." From citations on this point the report proceeds to others on its observation that "Railroads may properly conduct motor vehicle operations that are auxiliary or supplementary to train service, under circumstances that permit of more economical and efficient handling of traffic in that manner, but in doing so they may not invade the territory of an established motor carrier."

The latter situation would result, the report continues, if the application were approved in full; and it cites an instance where motor carriers serving one of the districts proposed to be covered have indicated a willingness to make joint arrangements with the K. C. S. for handling the traffic involved.

* * * *

Equipment and Supplies

LOCOMOTIVES

THE ROBERVAL & SAGUENAY reported in the *Railway Age* of February 13, as inquiring for one locomotive, has taken delivery of a consolidation (2-8-0) type locomotive from the Canadian Locomotive Company. This locomotive has a weight on drivers of 206,000 lb. and a maximum tractive power of 47,300 lb. The tender is of the eight-wheel type with a capacity for 7,000 imperial gallons of water and 14 tons of coal.

PASSENGER CARS

THE SOUTHERN PACIFIC has ordered two tavern and two coffee shop style cars from the Pullman Standard Car Manufacturing Company, the four cars being in addition to the 41 cars ordered during the first part of the year and reported in the *Railway Age* of February 13.

IRON AND STEEL

CENTRAL OF NEW JERSEY.—A contract has been let to the Bethlehem Steel Company for 566 tons of structural steel to be used in connection with the construction of the depressed highway and three bridges at Trumbull street, Elizabethport, N. J. The Ell-Dorer Contracting Company are the contractors.

MOTOR VEHICLES

THE CANADIAN PACIFIC has received delivery of one 23-passenger bus and one 31-passenger bus from the Twin Coach Company.

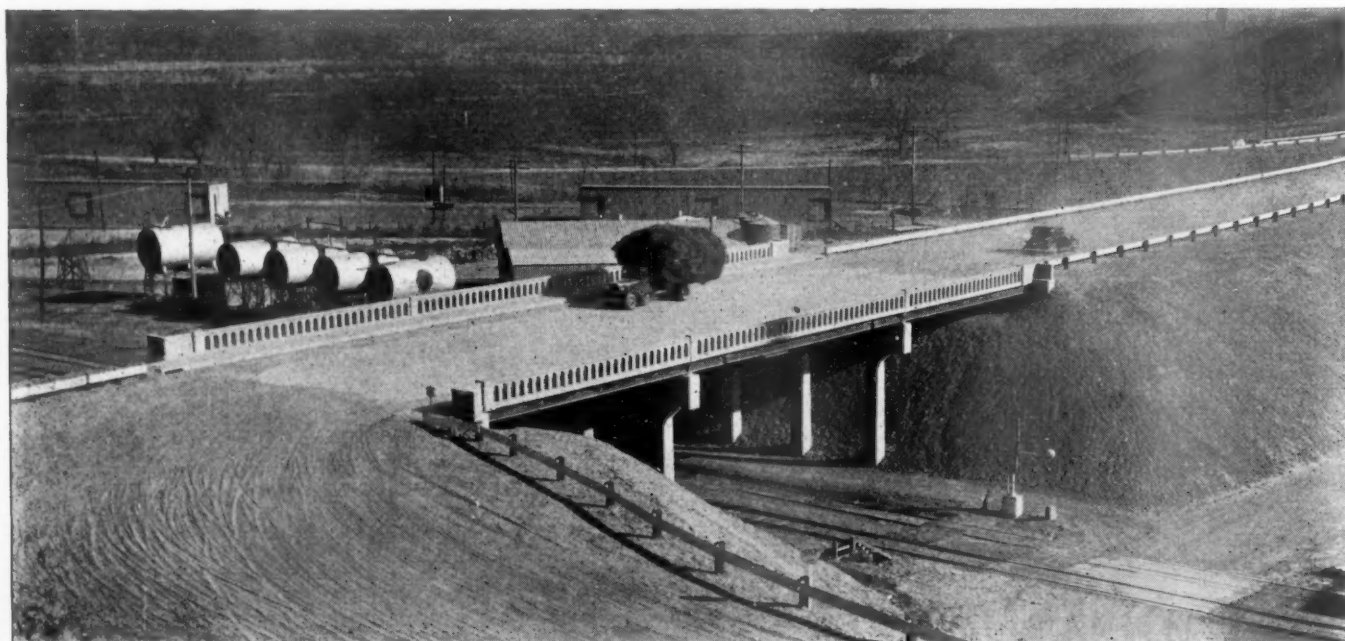


Photo Courtesy U. S. Bureau of Public Roads

Federal Works Program Grade Crossing Project Completed on the Colorado & Southern in Pueblo County, Colo.

Continued on next left-hand page

NO. 23 OF A SERIES OF FAMOUS ARCHES OF THE WORLD



THE GATEWAY AT NICAEA

The ancient city of Nicaea (modern name Iznik) was founded about 300 B.C. and is surrounded by high stone walls with imposing towers and gates. The area enclosed is about twelve miles long and four miles wide. There are two battlement walls separated by a distance of about 50 feet. On the inner walls there are 108 towers and 130 on the outer walls. These towers are so located as to alternate the inner and outer positions. Three of the original four gates are still well preserved. One of the gates of white marble was

built about 120 A.D. by Hadrian and is in the form of a Triumphal Arch. The city walls are 15 to 20 feet thick and are still 30 to 40 feet high.

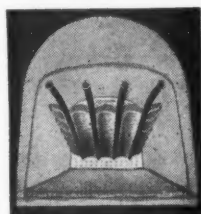
* * *

The Security Sectional Arch, introduced and developed by the American Arch Company, was the first practical locomotive firebox arch. Its development paralleled modern locomotive development. It is today an essential factor in the economic operation of modern trains.

THERE'S MORE TO SECURITY ARCHES THAN JUST BRICK

**HARBISON-WALKER
REFRACTORIES CO.**

Refractory Specialists



**AMERICAN ARCH CO.
INCORPORATED**

*Locomotive Combustion
Specialists* * * *

Construction

CANADIAN NATIONAL.—This company and the City of Edmonton, Alta., are contemplating the construction of a subway to carry Ninety-sixth street in that city under the tracks of the Canadian National, at a cost of about \$385,000.

CENTRAL OF NEW JERSEY.—A contract has been let to the Ell-Dorer Contracting Company, Irvington, N. J., for the construction of the depressed highway and three bridges at Trumbull street, Elizabethport, N. J., to cost about \$233,724. This includes the use of 566 tons of structural steel ordered from the Bethlehem Steel Company.

THE DELAWARE & HUDSON.—A contract has been given to the Wilson & English Construction Co., New York, for the elimination of various grade crossings of this road in the village of Cobleskill, N. Y. See *Railway Age* of July 3, page 30.

INTERNATIONAL-GREAT NORTHERN.—The City of San Antonio, Tex., has made preliminary plans for the construction of a reinforced concrete and steel underpass to carry Fredericksburg road under the tracks of this company. This project will cost about \$250,000, of which \$200,000 will be advanced by the federal government and the remainder by the city.

LEHIGH VALLEY.—A contract has been let to A. S. Wikstrom, Bound Brook, N. J., for grade crossing elimination work on this road, in the town of Ithaca, N. Y., to cost about \$150,000. See item in *Railway Age* of June 26, page 1074.

MISSOURI-KANSAS-TEXAS.—Preliminary plans have been drawn for the construction of an underpass to carry East Houston street, San Antonio, Tex., under the tracks of this company. The cost of this project will be about \$104,000, the largest part of which will be advanced from funds allotted by the federal government.

NORTHERN PACIFIC.—A contract has been awarded to Standard Construction Company, Tacoma, Wash., for the construction of a one-story addition to this company's enginehouse and shops at Pasco, Wash., at a cost of about \$40,000.

ST. LOUIS, BROWNSVILLE & MEXICO.—The trustee of this road has applied to the Interstate Commerce Commission for authority to construct a 4.28-mi. extension of its line from a point near Brazoria, Tex., to a plant of the Jefferson Lake Oil Company.

TERMINAL RAILROAD ASSOCIATION OF ST. LOUIS.—A contract has been awarded to the Fruin-Colnon Contracting Company, St. Louis, Mo., for the construction of a reinforced concrete subway to carry Broadway beneath eight tracks between Third street and a point 110 ft. west of John street. The subway will be about 900 ft. long and will have a 40-ft. roadway with a 6-ft. sidewalk on either side. The estimated cost of the project is \$200,000.

Supply Trade

G. W. Hoskins has joined the **Harnischfeger Corporation**, Milwaukee, Wis., as sales engineer for Smootharc welder and weld rods in the P&H Philadelphia, Pa., territory.

The Standard Railway Equipment Company and its associate, the **Union Metal Products Company**, have opened an office in the Terminal Tower, Cleveland, Ohio, in charge of **J. H. Schroeder**, assistant to the vice-president. Mr. Schroeder had been previously in charge of the St. Louis office of the above companies.

Marshall M. Cooledge has been appointed sales representative of **The Buckeye Steel Castings Company**, with office at 50 Church street, New York City. Mr. Cooledge is a graduate engineer, class of 1926, of the University of Illinois. He was connected with the Timken Roller Bearing Company in sales and engineering on the Pacific Coast, and later with the Joseph T. Ryerson & Son, Inc., in the St. Louis district, before joining the Buckeye organization.

H. H. Rogge, manager of the New York sales division since 1935, of the **Westinghouse Electric International Company**, New York, has been appointed sales manager of the company, with headquarters, as formerly, at New York. Mr. Rogge was graduated from the Brooklyn Polytechnic Institute with a degree in electrical engineering. He joined the Westinghouse Company in 1922, after a service of four years as assistant electrical engineer in the United States Navy Department, and then to 1925 was located at the Westinghouse East Pittsburgh works in the engineering department. The following year he went with the Westinghouse Electric International Company as special representative in the Netherlands East Indies, returning to New York in 1929. Three years later he was appointed manager of the Syndicate division and, since 1935, served as manager of the New York sales division, until his recent appointment as sales manager.

OBITUARY

George P. Dirth, southwestern manager of the Okadee Company and the Viloco Railway Company, with headquarters at St. Louis, Mo., died suddenly at Springfield, Ill., on July 8.

French Collision Kills Nine

Nine persons were killed and 30 injured on the French State Railways at Le Mans, on July 10, when a passenger train crashed into the rear of a preceding passenger train that had halted at a block signal. The collision occurred approximately a mile from the Le Mans station, on the line which extends north to Caen.

Financial

BOSTON, REVERE BEACH & LYNN.—*Bankruptcy.*—This company on July 13 filed a petition in the federal court at Boston for reorganization under the federal bankruptcy act. The action was forecast on the preceding day when directors voted to omit interest due July 15 on \$1,000,000 of first mortgage bonds.

BUTTE, ANACONDA & PACIFIC.—*Stock.*—This company has been authorized by the Interstate Commerce Commission to issue \$2,500,000 of capital stock, consisting of 25,000 shares of \$100 par value, to be sold at 133.87 per cent of par with the proceeds applied to the redemption on August 1 of \$1,491,000 of the road's first-mortgage 5 per cent 30-year sinking-fund gold bonds, and to the reimbursement of the applicant's treasury for capital expenditures.

CHICAGO, BURLINGTON & QUINCY.—*Motor Carrier Acquisitions.*—The Burlington Transportation Company, highway affiliate of this road, has filed with the Interstate Commerce Commission three applications in connection with proposed acquisitions of other motor carriers. The first seeks authority to acquire 50 per cent of the capital stock of the Black Hill Stages, Inc.; the second seeks approval of a contract to acquire the property and operating rights of Bell Transfer, Inc., between Kansas City, Mo., and St. Paul, Minn., and Minneapolis, and between Kansas City and Chicago; and the third seeks approval of a lease of the operating rights of the Metropolitan Motor Coach Company between Chicago and Aurora, Ill. Meanwhile, one of the above—Black Hills Stages, Inc.—has filed a separate application for authority to acquire the operating rights of the Black Hills Transportation Company.

CHICAGO GREAT WESTERN.—*Equipment Trust Certificates.*—Trustees of this company have applied to the Interstate Commerce Commission for authority to assume liability for \$1,500,000 of 3½ per cent equipment trust certificates to be issued in connection with the refinancing of leases with the Pullman Company under which the C. G. W. has been using 3,600 freight cars. All of these cars, except six which have been destroyed and 1,300 for which the C. G. W. under the leases is now entitled to receive the bill of sale, will be pledged under the trust. The certificates which have been awarded, subject to I.C.C. approval, to Solomon Brothers & Hutzler for 100.135 per cent of par and accrued dividends, will mature in semi-annual installments of \$75,000 each from December 1, 1937, to June 1, 1947.

CHICAGO, ROCK ISLAND & PACIFIC.—*Reorganization.*—The Interstate Commerce Commission has ordered included in the record of this road's reorganization proceedings a supplemental report, dated June 21, prepared by the Bureau of Valuation, and giving valuation data on the Rock Island and its affiliates.

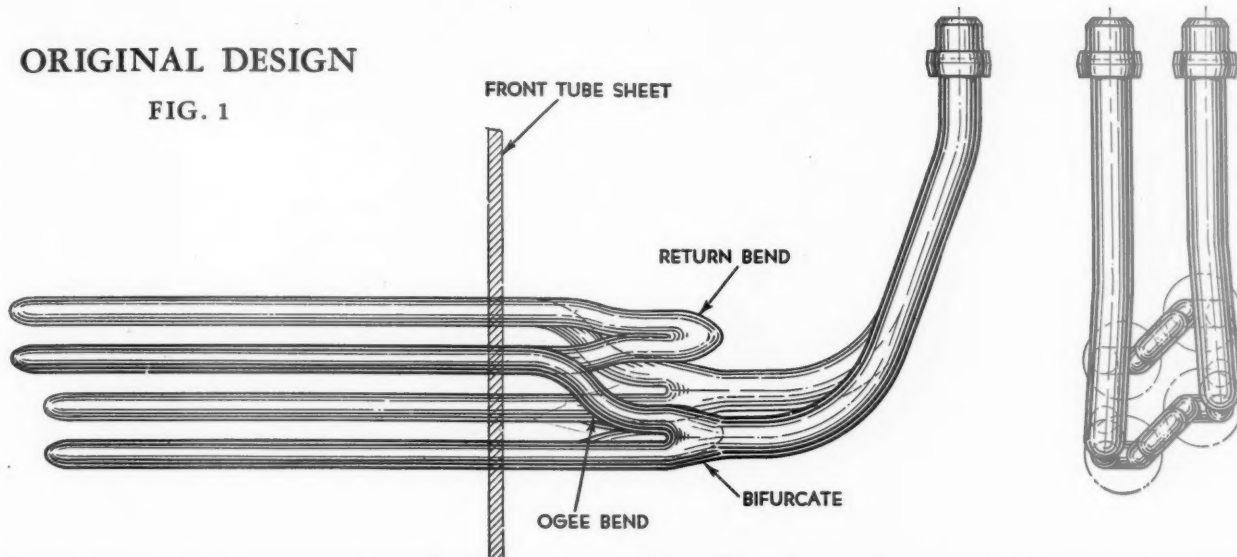
CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC.—*Abandonment and Acquisition.*—Examiner J. S. Prichard has recommended

Continued on next left-hand page

The Improved Type "E" Superheater Unit

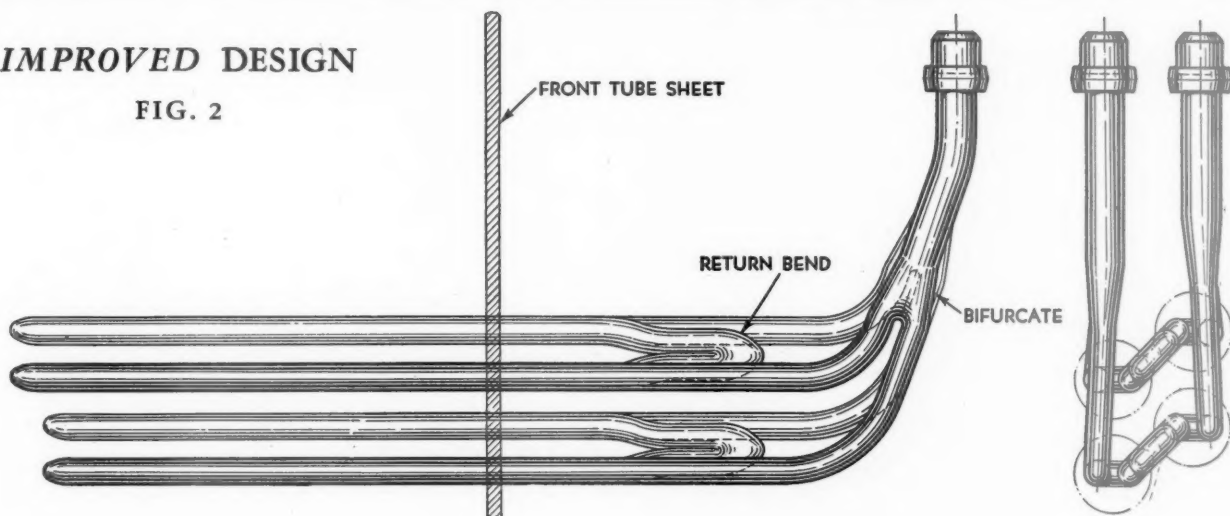
ORIGINAL DESIGN

FIG. 1



IMPROVED DESIGN

FIG. 2



- 1—The front return bends, bifurcates and pipe bends are now located much further ahead of the tubesheet. These changes, together with the elimination of the ogee bends, will result in less cinder wear on the units and shields (shields are not shown), thereby increasing their life and reducing the maintenance cost.
- 2—The new arrangement of the return bends and bifurcates in the front end will also reduce the obstruction to the gas in the front end, resulting in an improved draft condition.
- 3—Equal resistance through the units means equal steam distribution through each assembly.

“ “ ” ”

The improved units are interchangeable with old style units, either partially or in complete sets . . . Old style units sent to our plant for REmanufacture, will be refabricated in accordance with the improved design.



A-1155

THE SUPERHEATER COMPANY

Representative of AMERICAN THROTTLE COMPANY, INC.

60 East 42nd Street, NEW YORK

Peoples Gas Building, CHICAGO

Canada: THE SUPERHEATER COMPANY, LTD., MONTREAL

Superheaters « Exhaust Steam Injectors « Feed Water Heaters « American Throttles « Pyrometers « Steam Dryers

in a proposed report to the Interstate Commerce Commission that this road be authorized to abandon its 17.46-mi. branch line between Cannon Junction, Minn., and Cannon Falls; and to acquire a half interest in and operate jointly with the Chicago Great Western the latter's 21.6-mi. branch extending from Red Wing, Minn., to a point near Cannon Falls.

CHICAGO, ROCK ISLAND & PACIFIC.—Certificates of Indebtedness.—Trustees of this road have applied to the Interstate Commerce Commission for authority to issue \$27,000,000 of 10-year 3.5 per cent certificates of indebtedness to be exchanged for existing equipment trust certificates. It is proposed to issue the certificates directly, without underwritings or contracts.

ETTRICK.—Abandonment.—The Interstate Commerce Commission has authorized this company to abandon its entire line extending from a connection with the Green Bay & Western at Blair, Wis., to Ettrick, 10.5 mi.

MISSOURI PACIFIC.—Appeal Interest Order.—Leave to appeal an order of the district court authorizing payment of interest on first and refunding bonds of the Missouri Pacific and also on the bonds of its subsidiary, the New Orleans, Texas & Mexico, was granted counsel for the railroad by the district court at St. Paul on July 10. Previous to this action, the court had issued an order directing the trustee of the road to pay a total of \$6,601,012 interest on first and refunding bonds of the Missouri Pacific and \$1,141,675 on first mortgage and income bonds of the subsidiary. Pending appeal, the court stayed the latter order until July 20. The petition of the Missouri Pacific for leave to appeal opposes payment of interest on the grounds that such payments are unlawful and in contravention of the provisions of section 77b of the bankruptcy act.

NEW YORK CENTRAL.—Bond Conversion.—Final revised figures on the conversion of its \$59,911,100 of 10-year, 6 per cent convertible bonds, due May 10, 1944, were announced by the New York Central on July 9. A total of \$58,199,100 was turned in for conversion, leaving \$1,712,000 outstanding for redemption at 102 per cent, with interest to June 30. For redemption at 105, the road has called Series D, Big Four 5 per cent mortgage bonds totaling \$19,783,150; Series C, 6 per cent Big Four mortgage bonds at 103, totaling \$1,652,600, and \$1,477,000 of Kanawha & West Virginia first mortgage 5's at 105.

NEW YORK, NEW HAVEN & HARTFORD.—Abandonment.—Trustees of this road have applied to the Interstate Commerce Commission for authority to abandon the 5.47-mi. line between East Thompson, Conn., and Webster, Mass.

NEW YORK, NEW HAVEN & HARTFORD.—Abandonment.—Trustees of this road have applied to the Interstate Commerce Commission for authority to abandon the 3.3-mi. line between Melrose, Conn., and Ellington.

OHIO & MORENCI.—Acquisition.—This company has been authorized by the In-

terstate Commerce Commission to acquire and operate various switching tracks, totaling about 1.7 mi., of the abandoned Blissfield in and around Blissfield, Mich.

OUACHITA & NORTH WESTERN.—Stock.—The Interstate Commerce Commission, Division 4, has authorized this company to issue \$30,300 of capital stock, consisting of 3,030 shares of the par value of \$10 a share, in exchange for a like number of shares of \$100 par value.

PACIFIC GREYHOUND LINES.—Notes.—This company has applied to the Interstate Commerce Commission for authority to issue to the American Trust Company of San Francisco, Calif., \$800,000 of 3 per cent notes to be secured by a chattel mortgage on 100 new General Motors buses to be purchased this year. The notes are to be repaid in four years at the rate of \$70,000 quarterly.

TENNESSEE & NORTH CAROLINA.—Abandonment.—This road has applied to the Interstate Commerce Commission for authority to abandon its Newport division, extending from Newport Junction, Tenn., to Crestmont, N. C., 21 mi.

UNION PACIFIC.—Equipment Trust Certificates.—The Interstate Commerce Commission has authorized this company to assume liability for \$10,410,000 of 2¾ per cent equipment trust certificates, series E, to be sold at 101.133 and accrued dividends to a banking group comprised of Salomon Brothers & Hutzler, Dick & Merle-Smith and Stroud & Company, Inc., highest of five bidders for the issue. On this basis the average annual cost to the U. P. will be about 2.588 per cent, and the certificates will mature in 15 annual installments of \$694,000 on July 1 of each year 1938 to 1952.

WABASH.—Reorganization Plan.—A plan of reorganization for this road, which would reduce annual fixed charges to \$3,232,527, was filed in the federal district court at St. Louis by its receivers on July 14. The plan calls for the consolidation of the Wabash and the Ann Arbor, and issuance of new securities. Only two issues of mortgage bonds would remain undisturbed, those being \$2,190,000 of 4 per cent first mortgage serial bonds of the Wabash-St. Charles Bridge Company, and \$350,000 of first mortgage 3½ per cent serial notes of the Wabash-Hannibal Bridge Company. Stockholders would have the alternative of paying an assessment of \$7 per share or receiving a reduction in equity.

Average Prices of Stocks and Bonds

	July 13	Last week	Last year
Average price of 20 representative railway stocks..	52.80	52.37	53.74
Average price of 20 representative railway bonds..	79.47	79.81	80.51

Dividends Declared

Kansas City, St. Louis & Chicago.—6 Per Cent Preferred Guaranteed, \$1.50, payable August 20 to holders of record July 20.
 North Carolina R. R. Co.—7 Per Cent Guaranteed, \$3.50, semi-annually, payable August 1 to holders of record July 21.
 Wheeling & Lake Erie.—4 Per Cent Prior Lien, \$1.00, quarterly; 5½ Per Cent Preferred, \$1.37½, quarterly, both payable August 1 to holders of record July 24.

Railway Officers

EXECUTIVE

H. P. Henshaw, assistant to vice-president of the Chesapeake & Ohio at Huntington, W. Va., has had his jurisdiction extended to include the Pere Marquette on matters pertaining to public relations.

OPERATING

A. Legault, roadmaster on the Canadian Pacific, with headquarters at Montreal, Que., has been promoted to assistant superintendent of the Laurentian division with the same headquarters.

W. J. MacGreevy has been appointed general manager of the Ohio Valley department of the Railway Express Agency, Inc., with headquarters at Cincinnati, Ohio, effective July 1, to succeed **W. E. Beckner**, retired, and **J. F. Glover** has been made general manager of the Trans-Missouri department, with headquarters at Omaha, Neb., succeeding Mr. MacGreevy, while **J. G. Shannon** became assistant to the vice-president, Central departments, at Chicago, vice Mr. Glover. **W. M. Smith** has been appointed superintendent of organization and chairman of the Standard Practices committee, with headquarters at New York, succeeding Mr. Shannon.

Succeeding Mr. Smith, **S. F. Pitcher** has been installed as superintendent of organization, with headquarters at Atlanta, Ga., and **H. B. Magill** has been appointed superintendent of the Georgia division, at the same city, succeeding Mr. Pitcher. **W. O. R. Hannan**, formerly general agent at Memphis, Tenn., has succeeded **E. E. Honn**, retired, as superintendent of the Arkansas division, with headquarters as before. **J. D. Anderson** has been appointed superintendent of the Central Iowa division, succeeding **D. K. Brown**, deceased.

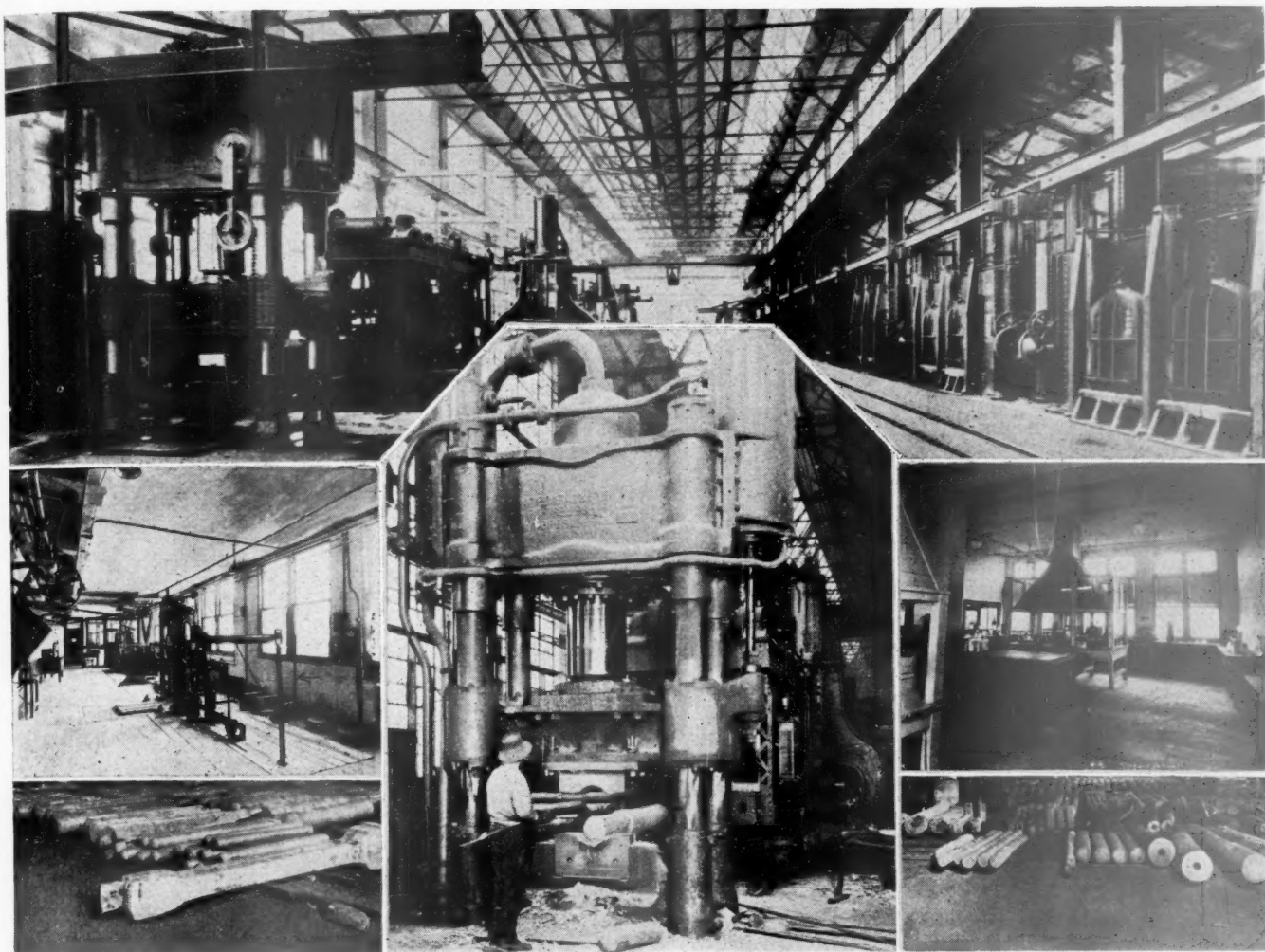
TRAFFIC

R. T. Watt, chief clerk to the perishable traffic manager of the Missouri Pacific, has been appointed to the newly-created position of general perishable freight agent, with headquarters at St. Louis, Mo.

Francis X. Bell, general agent for the Wabash at San Francisco, Cal., has been transferred to Los Angeles, Cal., to succeed **C. V. Ecclestone**, retired. As noted in the *Railway Age* of July 3, **George W. Terry**, general agent at Salt Lake City, Utah, has been transferred to San Francisco to succeed Mr. Bell.

W. A. Wilson, district freight representative of the Baltimore & Ohio and the Alton Railroad Company, with headquarters at Milwaukee, Wis., has been appointed division freight agent for those roads at St. Louis, Mo., succeeding **E. H. Yarke**, who has been promoted. **M. R. Scanlon** will succeed Mr. Wilson as district freight representative at Milwaukee.

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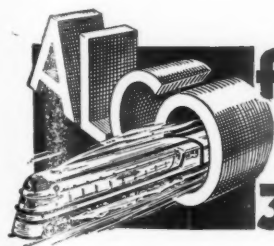
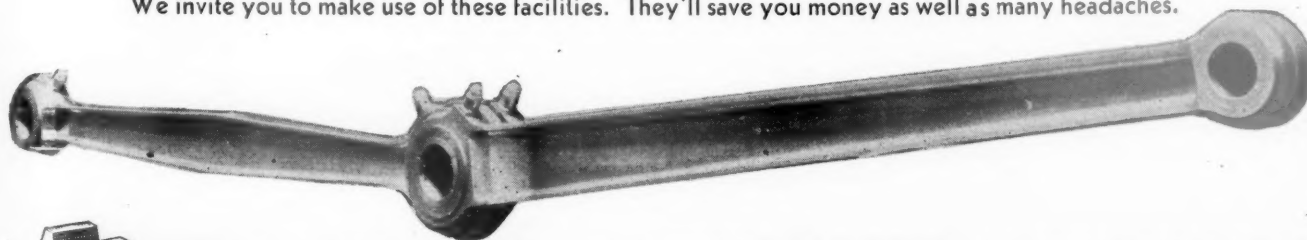
ALCO *Light-Weight* FORGINGS

It will pay you to consider ALCO alloy steel forgings for your existing power.

Complete and thoroughly modern facilities installed by ALCO for the scientific fabrication and heat treatment of high-grade alloy steel forgings enable this company to furnish light-weight, alloy steel main rods, side rods, piston rods and numerous other locomotive details of unexcelled excellence as to strength, rigidity and serviceability.

Have you sufficient work of this kind to justify the cost of installing and operating a special alloy steel forging and heat-treating department? If these costs seem excessive—and we believe they will be—remember ALCO has the finest kind of equipment, as well as a highly competent and experienced personnel, for alloy steel forging manufacture.

We invite you to make use of these facilities. They'll save you money as well as many headaches.



AMERICAN LOCOMOTIVE COMPANY

30 CHURCH STREET · NEW YORK · N.Y.

MECHANICAL

C. T. Ripley, chief mechanical engineer of the Atchison, Topeka & Santa Fe, with headquarters at Chicago, has taken a leave of absence. **Paul J. Danneberg**, general foreman at Argentine, Kan., has been promoted to master mechanic of the Slaton division of the Panhandle & Santa Fe (part of the Santa Fe System), with headquarters at Slaton, Tex., to succeed **W. P. Hartman**, who has been transferred to Argentine, where he replaces **J. M. Nicholson**, who has been transferred to Chicago. Mr. Nicholson succeeds **J. P. Morris**, who has been appointed to the newly-created position of mechanical assistant in the general office at Chicago.

ENGINEERING AND SIGNALING

L. V. Lienhard, roadmaster on the Atchison, Topeka & Santa Fe at Pueblo, Colo., has been appointed acting division engineer, with headquarters at Dodge City, Kan., to succeed **R. G. Whyman**, who has been granted a leave of absence.

P. P. Wagner, assistant engineer on the Missouri Pacific at Osawatomie, Kan., has been appointed acting division engineer of the Wichita division with headquarters at Wichita, Kan., to succeed **E. B. Fithian**, who has been granted a leave of absence.

S. B. Higginbottom, supervisor, telegraph and signals, of the Pittsburgh division of the Pennsylvania, with headquarters at Pittsburgh, Pa., has been promoted to engineer, telegraph and signals, of the Western region, with headquarters at Chicago, to succeed **G. H. Lefold**, who has been transferred to Philadelphia, Pa.

P. X. Geary, assistant division engineer of the Ft. Wayne division of the Pennsylvania, with headquarters at Ft. Wayne, Ind., has been promoted to division engineer of the Delmarva division, with headquarters at Cape Charles, Va., to succeed **J. E. Vandling**, who has been transferred to the Buffalo division at Buffalo, N. Y., where he replaces **C. J. Henry**. Mr. Henry has been transferred to the Panhandle division, with headquarters at Pittsburgh, Pa. **J. L. Cranwell**, assistant

to division engineer in the office of the vice-president (operation) at Philadelphia, Pa., has been transferred to the Ft. Wayne division, with headquarters at Ft. Wayne, to replace Mr. Geary.

L. B. Porter, signal engineer of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed to the newly-created position of superintendent telegraph and signals in which capacity he will take over the duties of **E. A. Patterson**, superintendent telegraph, who died recently. Mr. Porter will have headquarters as before at Milwaukee, Wis. The positions of signal engineer and superintendent telegraph have been abolished.

PURCHASES AND STORES

C. S. Jones, district material supervisor on the Southern Pacific at West Oakland, Cal., has been promoted to division storekeeper, with headquarters at Portland, Ore., to succeed **J. F. McAuley**, whose death on June 21 was reported in the *Railway Age* of July 10. **V. R. Naylor**, general foreman at West Oakland, has been appointed district material supervisor at the same point to succeed Mr. Jones.

SPECIAL

J. F. Rector, director of publicity of the Missouri-Kansas-Texas, has been appointed director of publicity—advertising of the Missouri Pacific at St. Louis, Mo., succeeding **E. H. McReynolds**, who has resigned to become vice-president in charge of sales of the James Mulligan Printing & Publishing Company.

OBITUARY

Claude M. Bain, assistant general solicitor for the Norfolk Southern, died on July 12, in New York, at the age of 49.

William C. McCormick, general passenger agent of the Louisiana division of the Southern Pacific Lines in Texas and Louisiana, with headquarters at New Orleans, La., died suddenly of a heart attack on July 2 at his home in New Orleans. Mr. McCormick was a native of Marlin, Tex., and had been associated with the Southern Pacific for about 40 years. He

had held the position of general passenger agent at New Orleans since 1928.

William P. Newton, who retired in 1916 as general auditor of the St. Louis-San Francisco, died on July 9 at St. Louis, Mo., at the age of 82 years.

Edward E. Stetson, assistant engineer of the Pennsylvania, with headquarters at Chicago, died at his home at that point on July 13.

William Little Seddon, who retired as vice-president and consulting engineer of the Seaboard Air Line in 1936, died on July 12 at his home in Fredericksburg, Va. Born on October 14, 1862, in Stafford County, Va., and educated at the University of Missouri, he entered railroad



William L. Seddon

service in 1899 with the Seaboard Air Line, serving successively as instrumentman, resident engineer and assistant engineer, until, in 1905, he became chief engineer. In January, 1913, he became assistant to the president and three years later was appointed vice-president in charge of operation, becoming general manager in the following year. In March, 1920, Mr. Seddon was appointed vice-president and consulting engineer of the road, which, with the added service of chief consulting engineer for the receivers of the Seaboard after December, 1930, remained his duties until retirement in June, 1936.

* * * *



Lumber Stocks on the Pennsylvania at Columbus, Ohio

Operating Revenues and Operating Expenses of Class I Steam Railways

Compiled from 138 Monthly Reports of Revenues and Expenses Representing 142 Class I Steam Railways
FOR THE MONTH OF MAY, 1937 AND 1936

Item	United States		Eastern District		Southern District		Western District	
	1937	1936	1937	1936	1937	1936	1937	1936
Miles of road operated at close of month	235,873	236,789	58,343	58,637	44,779	44,935	132,751	133,217
Revenues:								
Freight	\$287,919,195	\$262,693,631	\$125,698,110	\$114,279,407	\$55,417,317	\$51,715,279	\$106,803,768	\$96,698,945
Passenger	34,042,178	30,348,307	19,187,819	17,522,128	4,380,541	3,777,072	10,473,818	9,049,107
Mail	8,244,748	7,910,388	3,165,065	3,059,290	1,443,764	1,440,431	3,635,919	3,410,667
Express	5,748,358	6,226,776	1,967,984	2,471,888	1,516,429	1,400,532	2,263,945	2,354,356
All other transportation...	7,341,478	6,909,177	3,879,146	3,708,066	758,372	696,218	2,703,960	2,504,893
Incidental	8,547,705	6,185,110	4,433,215	3,198,784	1,065,948	863,856	3,048,542	2,122,470
Joint facility—Cr.	1,075,381	904,506	301,311	259,405	249,452	236,090	524,618	409,011
Joint facility—Dr.	305,402	251,492	55,063	50,611	20,848	21,884	229,491	178,997
Railway operating revenues	352,613,641	320,926,403	158,577,587	144,448,357	64,810,975	60,107,594	129,225,079	116,370,452
Expenses:								
Maintenance of way and structures	46,629,620	40,752,817	17,759,933	14,701,035	7,384,196	6,726,732	21,485,491	19,325,050
Maintenance of equipment	71,463,147	63,855,364	32,796,539	28,532,929	12,846,901	11,539,639	25,819,707	23,782,796
Traffic	9,064,412	8,453,688	3,323,025	3,078,693	1,652,311	1,592,995	4,089,076	3,782,000
Transportation	123,925,950	111,863,803	56,618,994	51,329,105	20,288,931	18,594,741	47,018,025	41,939,957
Miscellaneous operations...	3,136,481	2,651,264	1,459,140	1,192,795	361,875	312,701	1,315,466	1,145,768
General	13,515,806	12,999,304	5,842,231	5,708,890	2,379,429	2,194,660	5,294,146	5,095,754
Transportation for investment—Cr.	438,975	374,446	60,834	23,306	51,865	48,024	326,276	303,116
Railway operating expenses	267,296,441	240,201,794	117,739,028	104,520,141	44,861,778	40,913,444	104,695,635	94,768,209
Net revenue from railway operations	85,317,200	80,724,609	40,838,559	39,928,216	19,949,197	19,194,150	24,529,444	21,602,243
Railway tax accruals	30,689,189	27,442,943	13,173,150	11,549,754	6,513,193	5,409,991	11,002,846	10,483,198
Railway operating income	54,628,011	53,281,666	27,665,409	28,378,462	13,436,004	13,784,159	13,526,598	11,119,045
Equipment rents—Dr. balance	7,818,041	8,177,861	3,406,798	3,829,022	759,360	793,819	3,651,883	3,555,020
Joint facility rent—Dr. balance	3,147,011	3,306,758	1,717,151	1,739,557	328,113	449,838	1,101,747	1,117,363
Net railway operating income	\$43,662,959	\$41,797,047	22,541,460	22,809,883	12,348,531	12,540,502	8,772,968	6,446,662
Ratio of expenses to revenues (per cent)	75.80	74.85	74.25	72.36	69.22	68.07	81.02	81.44
Depreciation included in operating expenses	16,281,130	16,169,942	7,271,131	7,066,428	3,122,543	3,191,540	5,887,456	5,911,974
Total maintenance before depreciation	101,811,637	88,438,239	43,285,341	36,167,536	17,108,554	15,074,831	41,417,742	37,195,872
Net railway operating income before depreciation	59,944,089	57,966,989	29,812,591	29,876,311	15,471,074	15,732,042	14,660,424	12,358,636

FOR FIVE MONTHS ENDED WITH MAY, 1937 AND 1936

Average number of miles operated	236,042	236,856	58,385	58,667	44,795	44,944	132,862	133,245
Revenues:								
Freight	\$1,423,248,440	\$1,257,004,000	\$625,206,104	\$550,941,817	\$282,076,441	\$254,216,833	\$515,965,895	\$451,845,350
Passenger	#173,184,149	#157,520,676	94,757,216	90,262,128	27,581,111	23,624,768	50,845,822	43,633,780
Mail	39,993,746	38,273,838	15,307,372	14,664,117	7,077,389	6,921,200	17,608,985	16,688,521
Express	24,165,315	23,696,325	9,458,207	9,306,051	5,948,215	5,776,124	8,758,893	8,614,150
All other transportation...	36,035,886	33,367,853	18,626,991	17,585,241	3,874,728	3,418,851	13,534,167	12,363,761
Incidental	35,296,044	28,907,989	18,274,689	15,762,091	5,471,703	4,626,947	11,549,652	8,518,951
Joint facility—Cr.	4,867,404	4,449,875	1,535,729	1,359,114	1,035,563	960,232	2,296,112	2,130,529
Joint facility—Dr.	1,179,777	1,180,885	278,356	251,685	112,132	105,036	789,289	824,164
Railway operating revenues	1,735,611,207	1,542,039,671	782,887,952	699,628,874	332,953,018	299,439,919	619,770,237	542,970,878
Expenses:								
Maintenance of way and structures	193,689,870	174,041,916	77,272,068	68,272,048	35,963,562	32,624,099	80,454,240	73,145,769
Maintenance of equipment	348,308,581	316,408,217	160,555,760	143,940,268	61,771,360	57,578,036	125,981,461	114,889,913
Traffic	43,384,664	40,391,960	15,978,111	14,863,098	8,345,003	8,070,785	19,061,550	17,458,077
Transportation	625,572,991	570,835,695	283,450,385	264,439,556	104,360,230	95,964,288	237,762,376	210,431,851
Miscellaneous operations...	16,330,732	13,790,900	7,363,099	6,423,663	2,421,792	1,981,888	6,545,841	5,385,349
General	67,606,222	65,164,846	29,445,534	28,658,555	11,726,158	11,087,452	26,434,530	25,418,839
Transportation for investment—Cr.	1,495,273	1,228,218	227,973	139,317	225,606	132,479	1,041,694	956,422
Railway operating expenses	1,293,397,787	1,179,405,316	573,836,984	526,457,871	224,362,499	207,174,069	495,198,304	445,773,376
Net revenue from railway operations	442,213,420	362,634,355	209,050,968	173,171,003	108,590,519	92,265,850	124,571,933	97,197,502
Railway tax accruals	150,341,481	122,000,354	63,843,860	50,585,574	33,006,672	25,405,444	53,490,949	46,009,336
Railway operating income	291,871,939	240,634,001	145,207,108	122,585,429	75,583,847	66,860,406	71,080,984	51,188,166
Equipment rents—Dr. balance	38,768,043	37,178,682	16,780,691	17,790,967	3,228,520	2,215,406	18,758,832	17,172,309
Joint facility rent—Dr. balance	15,458,846	15,721,470	8,689,141	8,662,216	1,520,381	1,781,236	5,249,324	5,278,018
Net railway operating income	\$237,645,050	\$187,733,849	119,737,276	96,132,246	70,834,946	62,863,764	47,072,828	28,737,839
Ratio of expenses to revenues (per cent)	74.52	76.48	73.30	75.25	67.39	69.19	79.90	82.10
Depreciation included in operating expenses	81,199,021	80,684,678	35,947,737	35,115,761	15,614,460	15,979,962	29,636,824	29,588,955
Total maintenance before depreciation	460,799,430	409,765,455	201,880,091	177,096,555	82,120,462	74,222,173	176,798,877	158,446,727
Net railway operating income before depreciation	318,844,071	268,418,527	155,685,013	131,248,007	86,449,406	78,843,726	76,709,652	58,326,794

* Includes \$683,670 sleeping and parlor car surcharge.

† Includes charges to Railway Tax Accruals in the total amount of \$7,977,635 itemized as follows: \$3,282,724 for taxes under the requirements of the Social Security Act of 1935, and \$4,694,911 under the requirements of an Act approved August 29, 1935, levying an excise tax upon carriers and an income tax upon their employees, and for other purposes. (Public No. 400, 74th Congress.)

‡ Includes charges to Railway Tax Accruals in the total amount of \$5,530,463 itemized as follows: \$1,453,272 for taxes under the requirements of the Social Security Act of 1935, and \$4,077,191 under the requirements of an Act approved August 29, 1935, levying an excise tax upon carriers and an income tax upon their employees, and for other purposes. (Public No. 400, 74th Congress.)

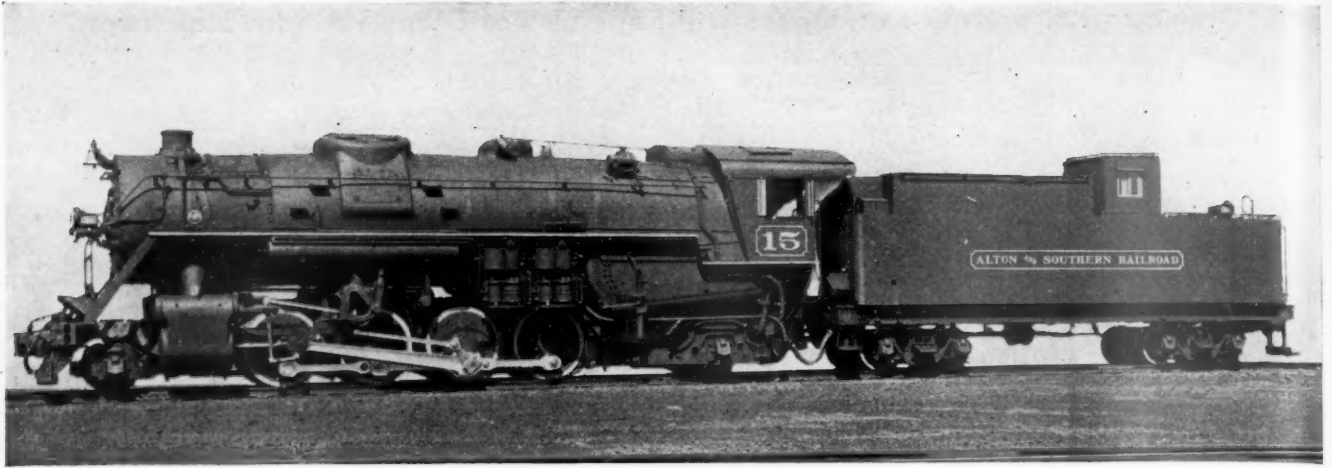
§ Includes \$7,070 sleeping and parlor car surcharge.

|| Includes \$3,931,670 sleeping and parlor car surcharge.

¶ Includes charges to Railway Tax Accruals in the total amount of \$39,037,293 itemized as follows: \$16,045,853 for taxes under the requirements of the Social Security Act of 1935, and \$22,991,440 under the requirements of an Act approved August 29, 1935, levying an excise tax upon carriers and an income tax upon their employees, and for other purposes. (Public No. 400, 74th Congress.)

§ Includes charges to Railway Tax Accruals in the total amount of \$19,220,970 itemized as follows: \$7,163,866 for taxes under the requirements of the Social Security Act of 1935, and \$12,057,104 under the requirements of an Act approved August 29, 1935, levying an excise tax upon carriers and an income tax upon their employees, and for other purposes. (Public No. 400, 74th Congress.)

Compiled by the Bureau of Statistics, Interstate Commerce Commission. Subject to revision.



ALTON AND SOUTHERN MIKADOS

This power was built for the Alton and Southern Railroad by Baldwin Locomotive Works. » » » Designed for freight service, it has a tractive effort of 64,300 pounds and a driving wheel diameter of 57 inches. The combined heating surface is 6,181 square feet and the grate area, 80.2 square feet. » » » It is fired by the Standard Stoker.

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